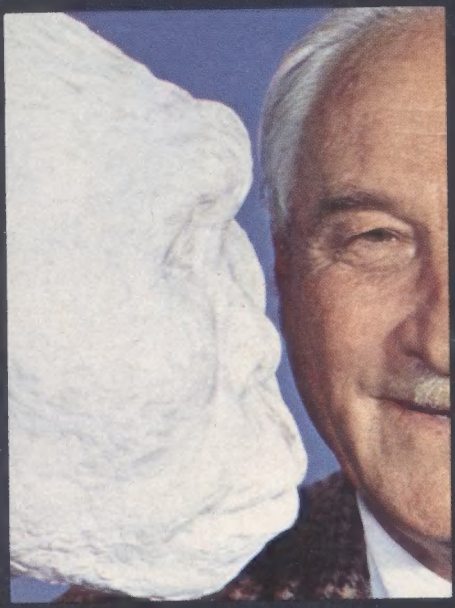
The science news monthly

SCIENCE DIGEST

NOVEMBER • 1966 50 CENTS ICD

THE MAN DR. LEAKEY DUG UP

Hot debate over our shadowy ancestry



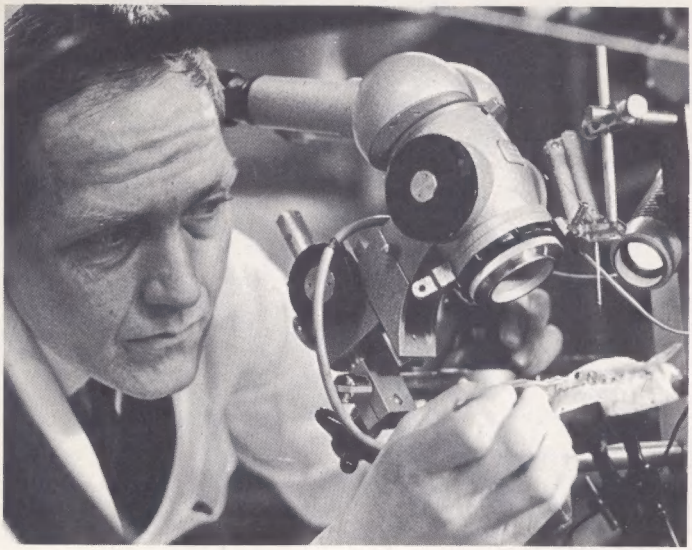
Also:

CANCERLESS CIGARETTES

DO-IT-YOURSELF PSYCHIATRIC TEST

HOW TO TREAT A HEADACHE

COLLEGE CRISIS OVER SCIENCE



Pictorial Parade

New brains for old

THE goldfish has shown in a miniature but momentous operation that the nerve fibers of its tiny brain can regenerate. It is the first small indication that replacing worn out human brains with vital new ones is more than just a dream. It is, in fact, the ultimate goal of a team of scientists at Edinburgh University.

Dr. Michael Gaze, Research Fellow of the Royal Society of Medicine, demonstrates above the goldfish brain's capacity to solder itself together. After the fish is duly anesthetized, the roof of its matchhead-sized brain is sliced off. It is replaced seconds later, resealed with plastic skin. To prove that the nerve fibers have reconnected properly, lights are flashed across the fish's eyes. Impulses generated from the retina—the sensitive film behind the eyes which projects the images received to the brain—are picked up by an electrode.

Human brain cells seem to have no such ability to reconnect. Dr. Gaze hopes that if human cells can be induced to multiply and their fibers to regenerate, then this work can be applied in brain accident surgery.

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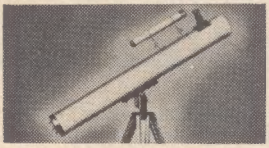

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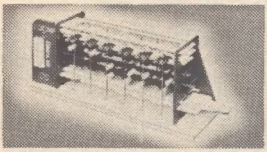

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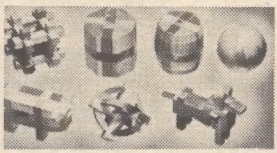

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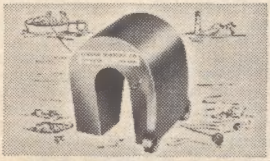

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THE year 1966 will be remembered for many things, but in the perspective of human history no event during this or any other year carries quite the significance of the one reported on page 10.

For the first time, man has been able to look at his mother planet as it spins through the dark vastness of universal space.

THIS MONTH

That first picture of our planet was even composed with the artistry of an accomplished photographer, with the craters of the moon close up in the foreground to contrast with the distant planet Earth, itself a sphere of light and shadow like any other celestial body coursing nobly around the sun.

Flip through this issue to page 72 and you'll look as if through the wrong end of a telescope to the other extreme of the scale of human history. At the same time that science is reaching to a future transcending our earthly existence, it is reaching to our beginnings in the shadowy past a million or two years ago, when apes were evolving into the human species.

Such views of what has been and what will be, help make science the most exciting, the most promising, the most rewarding pursuit in the world today. As we've said before in this space, science is knowing. This month, knowing has spread its wings wider than ever.

—THE EDITORS

The science news monthly

SCIENCE

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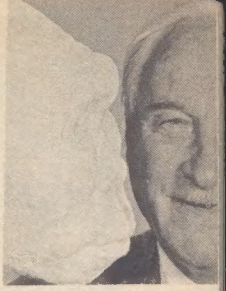

Maybe he wasn't handsome, but *Zinjanthropus* resembled this reconstruction. Based on the find of this extinct "cousin" of mankind and others, world-renowned Dr. Louis Leakey is revolutionizing anthropology's view of man's evolution (p. 72).

Photo: CBS-TV

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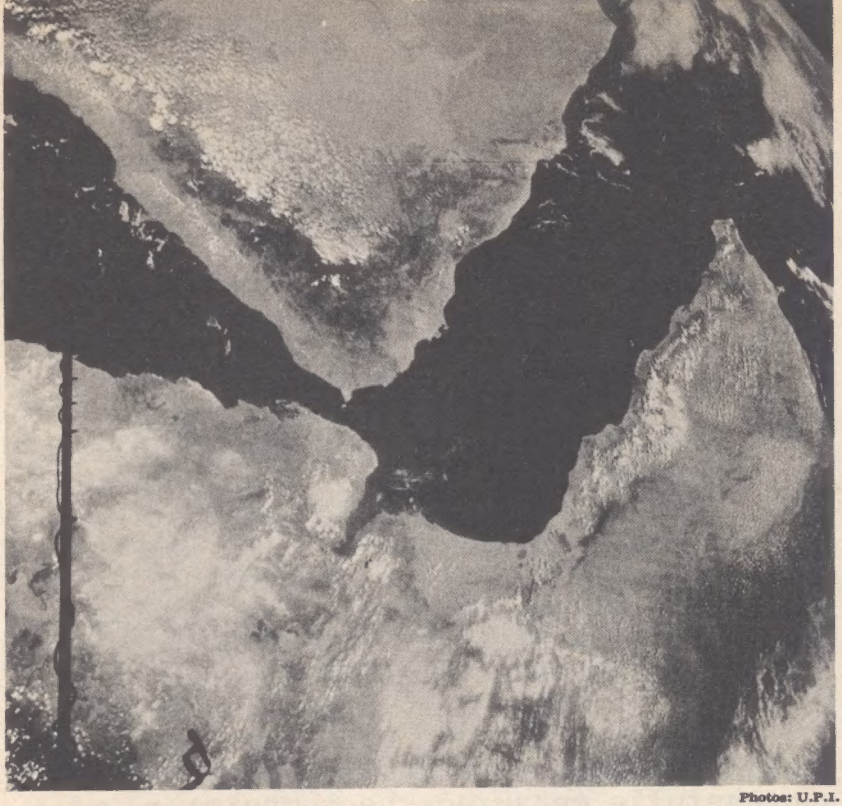
THE LATE SCIENCE NEWS

"IT'S FANTASTIC." Those were the words of Astronaut Charles Conrad as he looked out of the window of Gemini 11 when it soared to the record altitude of 850 miles, giving him and his partner Richard Gordon the widest view of earth man has ever had. (The view of Arabia and North Africa, top opposite page, was taken while Gemini 11 was a mere 450 miles up.) The three-day mission was remarkably successful and produced a mass of important data and many dramatic moments, like the moment when Gordon, "walking" in space, plunked down cowboy-like on the nearby Agena target satellite (opposite page, bottom).

EVA PUZZLE. The only major disappointment of Gemini 11 was that Gordon became so fatigued and sweaty that he had to cut his space walk short. Space walking, or more properly extra vehicular activity (EVA), has proved to be remarkably exhausting to the four astronauts who have tried it. Medical men are puzzled as to why astronauts' heart and respiration rates jump so drastically when they step outside their craft.

SECRETS OF LUNA 11. Russia's moon orbiting Luna 11 was up to something but no one was quite sure what, and the Russians weren't saying. The craft may have been taking pictures of potential manned landing spots but none were released. The craft was also huge, 3,608 pounds as compared to 850 pounds for Lunar Orbiter.



Photos: U.P.I.

DOWN THE HOLE. The Federal Government has poured $40 million down a hole that hasn't even been drilled yet and probably never will be. In August Congress finally killed the ambitious and controversial Project Mohole, amid charges of sharply rising costs and unsavory political influence.

AGAIN ATLANTIS. A Greek-American scientific team announced it has found evidence that the legendary Atlantis really existed. Prof. Anghelos Galanopoulos believes Atlantis should be identified with the submerged part of the Aegean island of Thera. Legend has it that Atlantis was a continent that sank into the Atlantic, but this idea is widely discounted today because there is no trace of a sunken continent.

COMET'S TEMPERATURE. Caltech scientists successfully measured the temperature of a comet for the first time. Training infrared detectors on Comet Ikeya-Seki, they found temperatures varied from 700 degrees F., when the comet was first picked up 45 million miles from the sun, to 1,200 degrees when it came within 20 million miles of the sun, at which point solar radiation blotted out the comet's own infrared emissions. On its return, temperatures dropped back to 700. The high temperature seems to rule out the commonly held theory that comets are merely chunks of dirt and gravel frozen together. Said one Caltech scientist, "Our observations show that there appear to be lots of metallic material." Another researcher commented, "We won't know the real answer until we send up a probe to bring back samples."

CHINESE SYNTHESIZE INSULIN. With tales of raging teenage fanatics filtering out of China in recent months, the news that Chinese scientists had successfully achieved the full synthesis of insulin--a noteworthy feat--came as a double surprise. According to West German scientist Dr. Klaus Hofmann, the achievement was "the most complex synthesis of a biologically active natural product accomplished to date." It required the linking together--each in its proper place--of 777 atoms into one giant and complex molecule. The Chinese discovery should have great medical value in the future.

DIABETIC MOUSE. Careful selective breeding has produced a strain of diabetic mice that are expected to give scientists a valuable tool for research into the cause, characteristics and possible cure of the disease.

HALOTHANE SAFE. A three-year study cleared the widely-used anesthetic halothane of the charge that in some cases it could cause fatal liver damage. Figures seemed to indicate that halothane was even safer than other general anesthetics commonly used.

VARIABLE DEATH RATE. The committee that investigated halothane made one disturbing finding. The post-operative death rates varied greatly among the 34 institutions that participated in the study. The lowest death rate for an institution was .27 percent, the highest 6.41 percent. Major differences still existed when the rates were adjusted for the type of operation and the age and physical condition of the patient. A followup on this finding was planned.

AMBITION AND HEART DISEASE. Men classified psychologically as overly aggressive, ambitious, competitive and preoccupied with deadlines were found to be extremely more prone to heart attacks. After a six-year study, a team of California researchers announced that it seems as if the hard driving man is still in danger of heart attack even if his blood pressure and cholesterol counts are low and if he gives up cigarette smoking and follows a sensible diet.

BAD GUY SURGERY. In old time movies you could always tell the bad guy because he was ugly or scarred. A pilot project in New York City prisons revealed that plastic surgery to remove scars or correct deformities can help turn bad guys into good guys. Out of a group of 244 convicts with deformities who were studied, men who had received corrective surgery had a 10 percent lower return-to-prison rate than those who had not.

ANTIBIOTIC WARNING. An advisory committee of the Food and Drug Administration warned of a "serious public health hazard" in the unrestrained use of antiobiotics in food-producing animals and as a food preservative. The committee noted that people can develop severe allergies to antibiotics and in rare cases these allergies can lead to death. In addition antibiotics in livestock feed can develop antibiotic resistant bacteria.

DELINQUENCY-FREE CHINATOWN. Psychologist Richard T. Sollenberger offered these reasons for the lack of delinquency in Manhattan's Chinatown: Close family ties, no corporal punishment and stress on education.

Do Unseen Powers Direct Our Lives?

ARE the tales of strange human powers false? Can the mysterious feats performed by the mystics of the Orient be explained away as only illusions? Is there an intangible bond with the universe beyond which draws mankind on? Does a mighty Cosmic intelligence from the reaches of space ebb and flow through the deep recesses of the mind, forming a river of wisdom which can carry men and women to the heights of personal achievement?

Have You Had These Experiences?

. . . that unmistakable feeling that you have taken the wrong course of action, that you have violated some inner, unexpressed, better judgement? The sudden realization that the silent whisperings of self are cautioning you to keep your own counsel—not to speak words on the tip of your tongue in the presence of another. That something which pushes you forward when you hesitate, or restrains you when you are apt to make a wrong move.

These urges are the subtle *influence* which when understood and directed has made thousands of men and women masters of their lives. There IS a source of intelligence within you as natural as your senses of sight and hearing, and more dependable, which you are NOT using now! Challenge this statement! Dare the Rosicrucians to reveal the functions of this Cosmic mind and its great possibilities to you.

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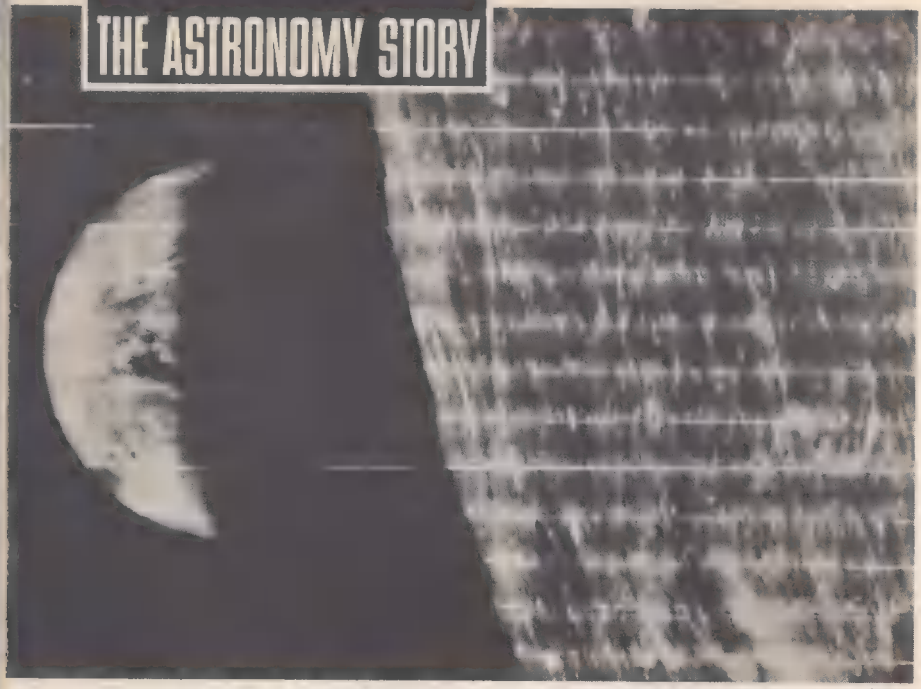
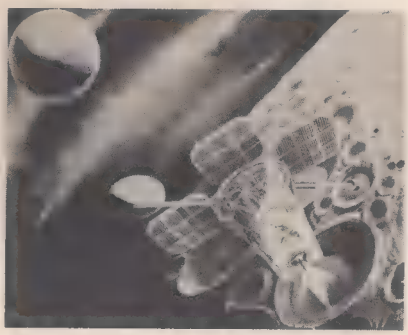
THE ASTRONOMY STORY



U.P.I.

The first photo of Earth from space was taken from the vicinity of the moon by Lunar Orbiter. It shows a crescent-shaped "last quarter" Earth. Compare this "far out" picture of our planet with photos of other planets taken from Earth on facing page.

The view from out there



Artist's conception shows Lunar Orbiter orbiting moon with Earth in background.

Is there any sign of life on earth? An explorer from another planet who had reached the vicinity of our moon would be hard put to answer that question unless he had photographic equipment far more sophisticated than that carried into orbit around the moon by our Lunar Orbiter spacecraft.

In addition to its primary job of taking pictures of the moon's surface to help locate a landing spot for Apollo, the vehicle also snapped

Good telescopic photo of Mars shows more surface details than Orbiter shot of Earth.

Saturn's famous rings make it the most identifiable planet in the solar system.

Photo of giant Jupiter displays characteristic bands despite distance from Earth.

two pictures of a crescent-shaped, "last quarter" Earth.

Astronomers hope that the Earth photos will help them interpret photos of other planets, particularly in regard to what effect the atmosphere has on sunlight. By comparing what the photos of Earth show with what photos of Mars reveal, for example, they get a better idea of the atmospheric density of Mars, a subject about which surprisingly little is known.

Earth's surface details, of course, are not visible in Orbiter's photos. The most scientifically valuable portion of the picture is the terminator —the line dividing sunlit and shadowed portions of the planet. Bodies like the moon without an atmosphere, have a sharp terminator.

Unfortunately, many of the moon photos taken by Orbiter were disappointing and did not advance the time of selection of an Apollo landing site as much as had been hoped.

But Lunar Orbiter was in no sense a failure. It responded accurately to more commands than any other unmanned craft, and aside from photos of the moon's known and hidden sides and of the earth, it also returned data that scientists called "truly significant."

By analyzing data from the craft, scientists hope to determine more precisely the shape, size, mass, density and perhaps even the origin of the moon. Already they have discovered that the moon, like many of us, and like the earth itself, is slightly pear-shaped.

Cancer — where doctors fail

by Arthur J. Snider

An indictment of physician laxity in diagnosing and treating cancer is contained in a report from the Henry Ford Hospital, Detroit, where 100 consecutive cancer patients were referred—too late to be helped.

An in-depth study was made to determine why they had reached so advanced a state without adequate treatment. It was found that 62 of the 100 had experienced a delay in diagnosis of more than three months. The doctor alone was to blame in 35 cases, the patient in 13, and both doctor and patient in 14.

In making the report, Dr. E. E. Moorhead II of Henry Ford Hospital reminded physicians: "Loss of public confidence in the medical profession is threatened when the public becomes convinced physicians are not doing all possible to protect them against the mutinies of their human and biological natures."

In the 27 cases in which the patients were wholly or partly to blame, ignorance of the seriousness of the symptoms was found in 20. Three recognized the importance of the signs but were indifferent. They were elderly or depressed, with little desire to live, particularly at the cost of submission to modern medical rituals.

Fear was present in 10 percent of patients, leading Dr. Moorhead to suggest wider educational programs stressing that early treatment of cancer is frequently simple, inexpensive and non-mutilating, whereas advanced cancer requires treatment that is more complex, expensive and often unsuccessful.

Dr. Moorhead classed physician delay under seven general headings:

1. Violations of the well known medical axioms: "A breast mass must be biopsied." "Skin lesions resistant to conventional therapy must be biopsied." "Blind, symptomatic treatment is worse than no treatment at all." He added: "Phy-

sicians must constantly remind themselves that the natural history of malignancy is not inexorably progressive. Symptomatic treatment often results in apparent improvement. Such response may lead both physician and patient to a false, possibly fatal sense of security."

2. Inadequate physical exam—failure to examine the area of symptomatology or to perform a complete examination.

3. Physical examination of dubious quality. In most of these cases, the physician fails to re-examine the area in question on subsequent visits, missing the opportunity to rectify his own error.

4. Failure to order appropriate X-rays.

5. Over-reliance on negative findings.

6. Failure of consultants to make proper diagnosis of malignant symptoms. A urologist, for example, missed a prostatic malignancy. A surgeon failed to discover tumors of the small bowel. A dermatologist treated an ulcerated melanoma as a fungus infection for six months.

7. Inadequate followup of patients, including failure to notify the patient of abnormal laboratory or X-ray results or failure to contact a patient who had not returned to the physician when requested.

Male resentment

Many women who are going through menopause are being denied the benefits of hormonal "youth pills" because their doctors envy women's biological superiority. Dr. Francis P. Rhoades of Detroit urges physicians not to let their "inherent male resentment of female longevity" deter them for their "medical responsibility of minimizing the menopause."

Other physicians deny women the pills because of a "deep philosophic reluctance to interfere with what is regarded as the inevitable process of aging," says Dr. Rhoades. "Those who regard the menopause as God's will should critically re-examine the traditional goals of their profession."

Dr. Rhoades says the advent of potent, effective and safe estrogen and progesterone hormones makes it unnecessary for women to suffer any longer the cosmetic and physiological effects that come with loss of female sex hormones in the menopause.

"The estrogens and progesterones provide therapeutic tools to make what has become almost half of a woman's life comfortable, healthy and productive," he says.

The average woman may plan today on living to age 80, he points out, thus adding to society a large number of post-menopausal females with the means and desire to preserve their femininity.

"It is only during the medical careers of a majority of physicians practicing today that women have lived long enough past their menopause to present a medical problem that cries for solution," he asserts. "The profession is under pressure to accept the new responsibility

being thrust upon them."

Onset of the menopause frequently brings with it loss in muscle strength, rise in blood pressure, increase in arteriosclerosis and changes in bone structure, including the "dowager's hump." There may be a one- to five-inch loss in body height over the years. Low backache is frequently reported. Loss of subcutaneous fat brings skin wrinkling.

"Fortunately, the cause—hormone deficiency—can now be diagnosed and effectively treated," Dr. Rhoades contends. "There are a number of orally active products now available that have been determined to be safe and effective."

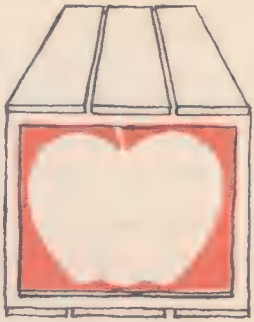
The widely-quoted fear of cancer development as the reason for withholding treatment with hormones is no longer tenable, he maintains. There is increasing evidence to support the opinion that cancer may occur less frequently than among those not receiving the benefit.

Apple-packer perils

The old adage, "An apple a day keeps the doctor away," doesn't apply to the apple production people—apple pickers, packers, sorters and thinners. At least four diseases have befallen the orchard folk.

First about 15 years ago, apple sorter's disease was discovered. It was a skin disease due to chemicals in which the apples were washed to prevent molds.

Next was found apple thinner's disease, a mild intoxication from the drug residues in workers who came in contact with trees recently sprayed. The third was apple picker's disease, discovered earlier this year and caused by a pesticide.



Now a fourth disease has to come to light—apple packer's nosebleed. Dr. Griffith E. Quinby of the Washington State Department of Health said it was discovered when an epidemic of nosebleeds occurred almost entirely among people who packed apples into boxes.

The cause was traced to dust and lint particles in the blue paper tray separating the layers of apples.

Powder warning

Can continuous exposure for years to household cleansers, dental powders and other supposedly micro-crystals be a hazard?

Dr. Hobart A. Reinmann of Philadelphia decided to study the subject after examining a patient who died of lung cancer after using a

denture cleaning powder in large amounts for three years.

On the basis of experiments, he found that normal animals, and presumably normal persons, are able to eliminate the microparticles, whether they enter the body by inhalation, by ingestion or through the skin.

Nevertheless, he cautions, crystals are apt to be retained in abnormal or previously injured tissue.

Hepatitis vaccine?

A development that could lead to isolation of the virus responsible for infectious hepatitis—and hopefully a vaccine to prevent it—has been achieved at Presbyterian-St. Luke's Hospital, Chicago.

Transmission for the first time to an experimental animal of the virus responsible for the contagious liver disease appears to have been accomplished. Dr. Friedrich Deinhardt, chairman of the department of microbiology, told the International Congress of Microbiology, meeting in Moscow, that the disease was produced in an animal relatively new to research—a marmoset—a primate with thick, wooly fur and a long, non-grasping tail.

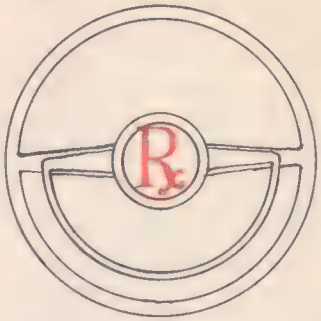
The first marmosets were brought to Chicago by Deinhardt in 1961. Despite predictions that the delicate animal would not survive transplantation of habitat from its native South America, the colony is thriving.

Blood serum of a jaundiced surgeon ill with hepatitis was injected into the marmosets, who came down with the disease. The virus has been recovered from the first group, injected into a second and recovered again. Six such passages have been achieved.

Drugged driving

As a means of preventing auto accidents, the nation's physicians are being urged to avoid unnecessary prescriptions of sedatives, tranquilizers and stimulants.

Twenty-one medical authorities comprising the editorial board of "The Medical Letter," an independent publication which evaluates drugs critically for physicians, said in a statement:



"Where sedatives or stimulants are genuinely needed, they may prevent accidents by calming the patient or increasing alertness. But much too frequently, patients with transient, mild nervousness or depression which does not require drug therapy are given prescriptions for sedatives, tranquilizers or

stimulants and may become habitual users."

Besides creating driving hazards themselves, many widely-used drugs are potentially dangerous because they add to the effect of alcohol, it was pointed out, and probably figure in many of the accidents attributed to drunken driving.

Some of the most hazardous drugs to driving are the most prescribed, such as phenobarbital and other barbiturates and meprobamate and diazepam. These drugs are prescribed for daytime use, it was emphasized, often without awareness that they frequently cause drowsiness and slow reaction time.

Leukemia drive

Leukemia is still considered an incurable disease but it need not be a quickly-fatal one. Fifteen years ago a child with acute leukemia lived two or three months. Today, two years is not unusual.

One of the contributing factors to the growing gains against the disease is the transfusion of blood platelets, tiny disc-shaped particles needed in blood clotting. Platelets are separated from donor blood by a process known as plasmapheresis. In the procedure, the red cells of the blood are immediately returned to the donor. Normal donors can give platelets as often as twice a week without ill effects.

Some leukemia patients treated with platelets have lived more than five years after diagnosis. As more persons are willing to donate platelets for transfusions, the average patient's time of survival will be extended.

Touch of pregnancy

An Oak Park (Ill.) physician is giving arthritis patients a "touch of pregnancy" to help control their disease.

Dr. Eugene F. Traut derived the treatment from the well-known clinical observation that pregnancy brings about striking improvement in several ailments, including arthritis, migraine and peptic ulcer.

Patients are injected with an extract of placenta, the hormone-rich after-birth, taken from pregnant women immediately after delivery.

In reporting results to the American Medical Assn., Dr. Traut said 24 of 27 patients with rheumatoid arthritis had marked relief of symptoms. Among 42 patients with mild to severe "old age" arthritis, 34 were improved to a marked degree and eight received no benefit.

Placentas were prepared within one-half hour after delivery. In the beginning, they were maintained in a frozen state for several weeks and then cut up. Recently, an improved extract has been made immediately on receiving the placenta.

The extract is injected into the muscle every third day. Dosage depends on progress. By contrast, ACTH, a hormone-type compound commonly used in the treatment of arthritis, must be injected daily.

Pushbutton expressway

Lights on map indicate traffic congestion to operator of push-button meter system.

Rush hour traffic that turns expressways into mammoth parking lots may one day be a horror of the past.

An electronic push-button system of traffic control has been installed in a six-mile stretch of congested expressway just outside of Chicago. As a result, drivers can cruise along at 40 mph., an unheard-of speed compared to the ulcer-causing crawl that occurs during the evening homeward dash.

The system controls the traffic flow by pacing vehicles entering the highway. Vehicles coming up tributary ramps are metered by traffic detectors—light signals—which are linked by a network of 35 telephone detectors to analog computors and recording devices in a central office.

Magnetic loop detectors imbedded in the lights record the presence of each car as it stops at the signal. As congestion on the expressway increases, the number of cars allowed to enter the stream of traffic decreases. This time spacing permits vehicles to enter the highway safely, one at a time (four to 12 per minute) instead of in clusters.

At the central office, a map of the "live traffic laboratory" provides a visual display of traffic conditions. Lights on the map indicate current traffic conditions at different locations.

Financed cooperatively by federal, state, Cook County and Chicago funds, the control system, the project engineers believe, can effectively improve driving safety.

Cars entering heavily traveled expressway are paced automatically to avoid traffic jam.

The search for a cancerless cigarette

Interview with Dr. Kenneth M. Endicott
Director of National Cancer Institute

by Victor Block

Do scientists know why or how cigarette smoking causes lung cancer? What are the harmful substances? Are they found in the tobacco, paper or the smoke, or are they created in the burning process?

No, scientists do not know exactly why or how smoking causes lung cancer. All of the carcinogens (cancer-causing agents) in tobacco and in cigarette smoke have probably not been identified and much more must be learned about them before tobacco's carcinogenic effects are fully understood.

As it enters the mouth and lungs, cigarette smoke is a concentrated aerosol with millions or billions of particles per cubic centimeter. An important factor determining the composition of cigarette smoke is the temperature in the burning zone. While air is being drawn through the cigarette, the temperature is higher than when the cigarette is burning without puffing. At both temperatures, however, many reactions occur. Some of the many compounds contained in tobacco remain in the ash. Many others, however, are oxidized, pyrolyzed (destroyed without oxygen) or undergo rearrangement, etc.

It is thus not surprising that more than 500 different compounds have been identified in cigarette smoke. Some of these belong to a class of chemicals known as polycyclic aromatic hydrocarbons. These have been found to produce cancer experimentally in animals when painted on the skin or injected under the skin.

Other materials in tobacco may be of importance in cancer causation. Certain substances, such as lactones, coumarins or polyphenols, which occur naturally in tobacco, have co-carcinogenic properties.

Radioactive substances, such as potassium 40 and polonium 210, have also been reported in tobacco smoke. These radioactive substances, however, occur in minute amounts in tobacco and, since they are not stored in the lung, their cancer-causing effect at this site is uncertain.

Tobacco smoke has been shown in many studies to interfere with the self-cleaning mechanism of the respiratory tract. This physiologic-pathologic effect may be as important as any chemical one in causing cancer of the lung.

What types of research are under way to pinpoint the hazardous substances in cigarettes. What progress is being made? What's the outlook for success?

Research now in progress or planned is focusing on determining the way smoking causes lung cancer and other diseases.

The U.S. Department of Agriculture, through a special appropriation from Congress, is engaged in a broad program of tobacco research at the University of Kentucky. This research involves the agricultural aspects of tobacco products as well as the analytical and biological aspects of tobacco and its combustion products. The appropriation specifically designates the Department of Health, Education and Welfare as the consultant body on the health aspects of this research.

The National Cancer Institute, in addition, has its own program. This includes investigations of alterations in the chemical and physical properties of mucus following exposure to cigarette smoke and how these changes may be related to the development of disease.

Other work is concerned with identifying in tobacco and in cigarette smoke agents which, though not cancer-causing in themselves, may increase the potency of cancer-causing chemicals.

In this connection, I would like to mention a very important aspect of all research on cancer causation and that is the necessity to take into account the fact that man, in his natural environment, is constantly exposed to a variety of agents. For this reason, tobacco is being studied in some instances as one of several factors in the development of lung cancer. In such studies, laboratory animals are exposed to tobacco smoke in combination with polluted air, viruses, small amounts of radiation and various chemicals.

In testimony before a Senate appropriations subcommittee earlier this year, you said there is an approach to descreasing the risks of lung cancer "which has not been adequately exploited. This is an aggressive program of research and development aimed at the cigarette itself, and reducing the carcinogenic hazard of cigarette smoking. I think this is technically feasible." Does this

(continued on page 22.)

Smoking and cancer tod

CANCER and other diseases, too, have been related to smoking in a number of studies, some of them quite recent. Here is the evidence as described by Dr. Endicott when interviewed by *Science Digest.*

What are the major ailments related to smoking?

According to the 1964 report of a special committee of experts appointed by the Surgeon General of the Public Health Service to evaluate the effects of smoking on health, the major ailments related to smoking are cancers of the lung, lip, larynx, esophagus and, possibly, bladder; two chronic respiratory diseases, bronchitis and emphysema; and coronary artery disease which leads to heart attacks. Only for cancers of the lung, lip and larynx has this relationship been established as causal.

Evidence for an association between tobacco and specific diseases comes from animal experiments, examination of patients, autopsy studies, and comparisons between death rates of smokers and non-smokers. Certain chemical compounds found in tobacco have been proved cancer-causing in animals. Tobacco smoke also produces experimentally in some animals the kinds of damage seen in the tissues of heavy smokers examined at autopsy. More than 30 population studies have revealed a higher death rate for smokers than for nonsmokers.

Please describe the types of research projects under way that are intended to further substantiate the evidence linking smoking with lung cancer, and with other diseases.

Since the advisory committee's report, findings from a government-sponsored, nearly-completed, 10-year study of 250,000 U. S. veterans have provided further evidence that cigarette smokers have a higher death rate than non-smokers for lung cancer and other diseases.

In addition, results of an American Cancer Society study have highlighted the health hazard of smoking for women, and a report from the National Center for Health Statistics has pointed out a significantly higher incidence of disabling illnesses and rate of loss of work days among cigarette smokers than among non-smokers.

Does smoking cigars or pipes have the same harmful effects as smoking cigarettes? How about filter tip cigarettes?

Pipe smoking seems to have been definitely established as a cause of lip cancer. In addition,

—what the evidence shows

five epidemiological studies have suggested that the risk of developing cancer of the lung is greater for pipe and cigar smokers than for non-smokers, but much less than for cigarette smokers. Cigar and pipe smokers are more likely than non-smokers to develop cancers of the mouth, esophagus and larynx, and stomach and duodenal ulcers.

The effectiveness of filter-tip cigarettes in preferentially removing harmful substances from smoke is not now very great.

[Certain brands of filter tip cigarettes permit more tar and nicotine to pass to the smoker than the same brand of regulars, according to a study done at Roswell Park Memorial Institute, cancer research and treatment center in Buffalo, New York. The survey maintains that these filter tips also pass nearly three times as much tar and nicotine as other filter cigarettes. Experiments have implicated tars and nicotine in the development of cancer and cardiovascular diseases, respectively.—Ed.]

Can you estimate the number of premature deaths in the U. S. each year due to cigarette smoking?

It is impossible to measure accurately the total number of deaths directly related to cigarette smoking in the U. S. population; it would also be impossible to estimate the number of "premature" deaths due to this cause. I can tell you, however, that the ratio of death rates of smokers to those of non-smokers is highest at earlier ages (40-50) and declines with increasing age.

Is cigarette smoking on the rise? What's being done to convince people that they should cut down or stop smoking, or, in the case of teen-agers, that they shouldn't begin?

Yes. Nearly 70 million people in the United States today use tobacco regularly. Since 1900, the number of cigarettes smoked per person has increased from 50 per year to approximately 4,000 per year. Intensive educational campaigns are being waged by various voluntary health agencies such as the American Cancer Society and the American Heart Association. The Federal Government has set up a National Clearinghouse on Smoking and Health to inform the public on the hazards of smoking and to conduct research on smoking behavior. And, of course, cigarette manufacturers are now required by law to print on packages, "Caution: Cigarette may be hazardous to your health."

mean that, if scientists can define the substances in cigarettes and the processes in smoking that cause or initiate lung cancer, you believe it would be possible to reduce or eliminate these harmful elements and develop a "safe" cigarette?

There is no doubt that it is now technically feasible to reduce the tar and nicotine content of cigarettes. Since the hazard associated with smoking increases with the amount and duration of smoking, any reduction in exposure to known harmful substances in smoke will inevitably reduce the hazard. Considerable progress is being made in reducing the harmful components of cigarette smoke, and as new classes of compounds are being identified, efforts to eliminate or neutralize them become feasible.

"f/8, stupid . . . f/8"

Can you place any odds, or give a word estimate, of the likelihood of development of a "safe" cigarette? What would be the earliest time we might expect it?

It is impossible to predict at present the time that would be required for the development of a "safe" cigarette. Certainly, a safer cigarette appears entirely within the realm of feasibility and it is only after assessing the effect of progressively safer cigarettes that we will be able to assess whether a completely harmless cigarette is possible.

Louis F. Fieser, a Harvard University chemist, has demonstrated that cancer-causing hydrocarbons, such as benz (a) pyrene, result from the burning of cellulose, which is present in all vegetable material, including tobacco. He is quoted as saying that "a very minute amount of benz (a) pyrene is capable of initiating cancer" and that, as a result, development of a "safe" cigarette is an impossible goal. What is your comment?

Dr. Fieser is indeed correct when he says the burning of cellulose, present in all vegetable material, will result in the production of carcinogenic hydrocarbons. A

threshold dose capable of initiating the cancer-causing effect of polycyclic hydrocarbons has been found to vary with the presence of co-carcinogenic agents. Such co-carcinogenic activity has been found in tobacco and tobacco smoke.

Although removal of the co-carcinogenic agents—a more feasible goal, perhaps, than removal of the small amounts of carcinogenic hydrocarbons in tobacco—would not prevent the inhalation of carcinogens, the effectiveness of the cancer-causing agents would be altered. Removal of the irritant component of the smoke would also lead to a potentially safer cigarette since the contact time between carcinogen and sensitive lung tissue would be reduced, though the carcinogenic hydrocarbons were still present.

What is the possibility of reducing or eliminating hazardous substances in cigarettes?

There are several approaches towards reduction of the hazardous substances in cigarette smoke. Among these are: 1) increasing the effectiveness of preferential filtration to remove co-carcinogens and irritants as well as carcinogens, 2) genetically altering the tobacco as grown so as to yield the lowest possible amount of cancer-causing agents on combustion, and 3) using additives to lower the amount of cancer-causing agents in the cigarette smoke. Any one or a combination of these should inevitably yield a safer cigarette.

Why Can't You Control Your Memory?

A noted publisher in Chicago reports there is a simple technique for acquiring a powerful memory which can pay you real dividends in both business and social advancement and works like magic to give you added poise, necessary self-confidence and greater popularity.

According to this publisher, many people do not realize how much they could influence others simply by remembering accurately everything they see, hear, or read. Whether in business, at social functions or even in casual conversations with new acquaintances, there are ways in which you can dominate each situation by your ability to remember.

To acquaint the readers of this publication with the easy-to-follow rules for developing skill in remembering anything you choose to remember, the publishers have printed full details of their self-training method in a new book, "Adventures in Memory," which will be mailed free to anyone who requests it. No obligation. Send your name, address, and zip code to: Memory Studies, 835 Diversey Parkway, Dept. C-788, Chicago, Ill. 60614. A postcard will do.

Marriage, divorce and remarriage

by Flora Rheta Schreiber and Melvin Herman

THE role of neurosis in marital difficulties has led experts recently to ask these questions:

If neurosis leads to a divorce, can a new marriage be any better?

Is divorce the only answer to neurotic difficulties in a marriage?

"Unfortunately we cannot arrange a legal separation from ourselves when we are divorced," says Cornelia B. Wilbur, M.D., director of psychiatric education for the state of West Virginia.

"We carry the seeds of divorce to our marriages. The neurotic choice of a partner is often the reason for divorce, indicating unresolved conflicts in ourselves which can be carried beyond a disastrous marriage."

"This is one reason," Dr. Wilbur says in a chapter on divorce in *The Why Report* a recent book of 45 interviews with psychiatrists, "that remarriages are twice as likely to

break up as first marriages are."

Morton Hunt, a veteran writer on sociological subjects, says in a new book, *The Formerly Married*, that emphasis on neurotic aspects of divorce is misleading.

He cites neurotic conflict as the most commonly held reason for divorce, but he feels that we should look at even more fundamental issues. Greater responsibility, he believes lies with social factors, such as increased urbanization, the decline of religion, the lessening of opposition to divorce, new mobility in the social structure and the increasing independence of women.

Hunt disagrees with psychiatrists like the late Dr. Edmund Bergher who said, "The neurotic is a repeating machine. No matter how often he marries, he always sets up the same neurotic mechanism."

Hunt agrees that, almost fatalistically, the divorced seek spouses who are reminiscent of their ex-husbands or wives. One man, in the informal studies Morton Hunt reports, said that his wife had been a pretty girl with a tart tongue and a witty manner who became a hostile woman who did everything she could to belittle him. After his divorce he became close to a woman who on the surface seemed totally different, a college instructor with what seemed to be admirable objectivity. Before long, however, he discovered that she used her intellectuality as his wife had used her wit—to belittle and to mock him.

Hunt's point is that the man ran from her. He had learned his lesson. The formerly married do not necessarily act neurotically.

Dr. Wilbur agrees with him. She says that successful new marriages often follow divorces. Husband and wife may emerge from a bad marriage with intense feelings of guilt, yet recognize that the destructive force was not of their own making, but only in the interaction between them. A new marriage can produce a much different pattern. It can be non-destructive, a good marriage.

But Dr. Wilbur adds, "There are more divorces than are really necessary, for everything isn't solved by breaking up a marriage."

On this point, Dr. Peter Laderman, a New York psychiatrist, says that the early years of marriage are the crucial ones. During these years, a person tests the misconceptions he developed as he grew up. They both must give up childish ways or the marriage will suffer. There must be respect for the other person and a willingness to engage in co-operative effort. Yet often what may seem to be a lack of respect may simply be a lack of knowledge about the other's needs. Feelings of anger often develop within a marriage and separate the couple either emotionally or actually.

Divorce also can be checked if couples recognize that marriage is always a potential source of stress. So real is this threat that Dr. Eric D. Wittkower and Dr. Eva P. Lester

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Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

recently investigated marriage as a telling sign in the development of illness. In predisposed men and women, they noted in their book, *Marriage Counseling in Medical Practice,* marital discord precipitates or aggravates psychosomatic illness.

The children of the divorced have long been the subject of controversy. The issue is whether the child fares worse when his parents are divorced than when they stay together in a state of conflict and tension. Many divorced parents insist that the very absence of conflict makes for their greater ability to give themselves more fully to their children. It's a very real question in some one-and-a-half million families which are headed by unmarried, divorced persons. Nine-tenths of the time these family heads are women.

Dr. Wilbur notes "that children may be better off if there is a divorce than if they live with parents who bicker constantly and use the children as pawns in their quarrels. The damage to children may be done long before the divorce. Yet every child would prefer to have his parents resolve their difficulties and assume their responsibilities to the family."

As Morton Hunt reminds us, three thousand Americans break up their marriages every day of the year. Nationally, the chance of divorce is one for every four marriages, but in the West it is nearly four times that of the Northeast and in one California county, San Mateo, the ratio is seventy divorces in one hundred marriages.

The formerly married make up a distinct sub-culture in society.

The young have more divorces. Among teen-age husbands the divorce rate is three times higher than in the total population, and among teen-age wives, it is four times higher.

Yet divorce is not entered into lightly. Typically, the decision to sunder the marriage comes three or four years after awareness that the marriage is unsatisfactory. It is also significant that no more than 5 percent of those seeking divorce go the easy route of residing temporarily outside their states in a community where divorce is easier.

Once the divorce is obtained, the new freedom is accompanied by loneliness, incompleteness, the need to be near other persons whose faces and voices can help fill the void, and, above all, the self-derogating sense of worthlessness. All these states of mind widen the gulf between the divorced and the married.

This gulf, and the difference in the lives of the formerly married, is the area Hunt explores. He sees them forming a sub-culture in a world with a separate set of norms, moral values and rules of fair play. No longer part of the main stream, they think and act differently from those who are married.

"My married friends are so stuffy," one divorcee responded to Hunt's questioning. "They have no

sense of the unknown, of the about-to-happen. How can they stand it?"

To show how far apart the thinking of the divorced and the married can go, Hunt tells the story of a divorced man who said one evening at the home of his best friends, "Marriage is an outmoded institution."

The remark cost him the friendship of his hosts. The wife told him: "We're like two little people who have been struggling 14 hours a day for years to make their corner candy store pay and get rid of the mortgage. Then you come along and tell us capitalism stinks and you're going to lead the revolution."

Although this man's love of his single blessedness represents the feelings of many who find a special titillation in living outside the bounds of domesticity, six out of seven divorced persons remarry.

Seven suitors

The free life has its disadvantages. Hunt tells the story of one 35-year-old woman who in five years of divorce had run through seven serious suitors. The woman, youthful and extremely attractive, had a teen-age daughter who, since she was 10, had watched her mother's beaus come and go. She had learned to care for each one in turn. At last, she became hurt and withdrawn, with an unspoken accusation against her mother: "It's you there's something wrong with, not them."

Both marriage and divorce have their problems. "Divorce is as useful an institution as marriage itself," says Dr. Wilbur.

"Not only is it often justifiable, but it may be the way to save two adults and their children from lives of misery. However, this caution must be added: Divorce is often only an escape from facing up to the need for a real solution to a problem."

Halfway houses

LEAVING a mental hospital is only the beginning of getting well. "The transition from illness to health cannot be a solo excursion," says Dr. George J. Wayne, Medical Director of Edgemont Hospital, Los Angeles.

The "halfway house" is one approach to this problem. Men and women who are well enough to leave a mental hospital but not yet ready to return to their home environments or to face life alone, can live in this sheltered yet permissive atmosphere. They may come and go as they like, talk over their readjustment problems with their psychiatrists, as necessary. As one young woman said, "When you're here, the outside world seems less threatening."

To see how halfway houses are shaping up, the authors recently visited Portals House in Los Angeles and Edgemont House in the same city.

Portals House was home to a group of young men and women with an average age of 26. A num-

ber were holding jobs. Some were away on visits to relatives with whom they soon would be reunited. All continued to see their psychiatrists.

One man had his own improvised studio in the garage. A young woman was renewing her connections with the time she remembered most happily by playing the piano. All of the young people enjoyed the chance to be themselves and the safety of the environment.

"When you're here," one woman said, "the outside world seems less threatening and the institution you left seems far behind."

Moving out of the hospital back into the world can be quite challenging. One girl's story speaks for almost all of them.

Optimism prevails

"I've been out of the hospital for about a month-and-a-half," she said, "and I feel more optimistic about myself than I can ever recall in my lifetime.

"It was rough at first. When I was told to pack, I was so unnerved that I just tossed my belongings helter skelter into boxes and waited anxiously for the state car to take me into Los Angeles.

"At Portals, I threw my boxes on the floor and flopped on my bed, not bothering to unpack because I was sure I'd not be fit for anything but being sent back to the mental hospital.

"The next day," the young woman went on, "I surprised myself by

Halfway houses act as buffers between hospital and outside world.

setting out for the bank to open a checking account. The plush bank, the immaculately groomed receptionist with the patronizing manner, the forms to be filled out, and the rules were too much for me. I fled back to Portal House, totally at a loss.

"But I was able to talk it over with the social worker. He said I had expected too much of myself. How could I possibly have known the bank rules beforehand? After that, I saw him every day. He was very honest but supportive.

"What I enjoy most besides this help is the privacy, being treated like an individual. There should be many more places like it."

Edgemont House is a two-story apartment house, with 18 individual apartments which can accommodate 36 persons. In each apartment, the kitchen-dining area has been converted into a study, since all meals are served in a common dining room. But it's an apartment house in appearance, not an institution.

Therapy continued

Men and women from 16 to 65 live here. They receive psychotherapy, individually or in groups, from a staff therapist at Edgemont Hospital next door or at the office of an outside psychotherapist.

The activities schedule is impor-

tant. Those who go to school or hold jobs during the day share in the evening activities—films, discussions, social or recreational programs.

Daytime projects are unlike hospital occupational therapy. Patients follow "real-life pursuits," cooking, sewing, typing, carpentry, gardening, etc.

Motivation important

The major asset at Edgemont, they feel, is the interlocking of hospital and halfway house staffs. Edgemont Hospital's Dr. Wayne says, "It is difficult to know in advance whether a patient will respond positively to the environment of the halfway house. It is a testing ground for individual motivation for recovery. The seemingly helpless patient can expand his limits. The ego functioning of very ill persons is sometimes adaptively catalyzed in an environment which is oriented toward recovery. Conversely, some patients who appear just right for the halfway house reveal minimal motivation when placed in that environment."

He adds: "Some of our guests remain at Edgemont House for only a few months; others may become life members. We are not prepared to say our rapid-turnover groups are our 'success' stories, nor that we have failed with our permanent guests.

"Even these, in a limited way, come closer to recovery in a halfway house than in a hospital."

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Before enhancement: fuzzy photograph. After: fine detail.

I see where they...

From the Editor's desk

...are performing photographic magic with computers. Pictures of the moon's surface by our exploratory craft have been made so sharp by computer research engineers that the shots show detail down to one-fiftieth of an inch in height.

The engineers worked out this technique: TV signals from the spacecraft are recorded on magnetic tape with each impulse registered as binary digits, or bits, in computer language. Every six bits determines the darkness of a point. The digits (010101, 101110, etc.) represent 64 shades ranging from white to black. The tape is fed into a computer, which reconstitutes the image according to the points and lines of the TV system used.

Noise in the transmission of the pictures to earth is eliminated by the computer as it compares the photograph's lines. After electronic correction, the bits are transferred to another tape, which is run through a film reproducer for the corrected photograph.

In the above before-and-after pictures, a footpad of Surveyor and its "footprint" lose their fuzzy look and emerge in sharp detail.

...have learned life-and-death details about grizzlies by outfitting them with radio transmitters. The National Geographic Society reports the findings—among them, these: About one-third of adult sows are candidates for motherhood each year, because females taking care of cubs or yearlings don't mate. Only 60 percent of the average annual crop of cubs survive the first year and a half. Male cubs outnumber females two to one, but among adults, females predominate.

What determines status in grizzly society? According to the report, it's dominance based on size, aggressiveness and experience.

...are using rats to solve a classic problem in psychology. The question is this: Are motivation and emotion qualitatively different or are emotions only intense motives?

The answer is that the two are apparently different, according to Dr. Edward L. Walker. He's a professor of psychology at the University of Michigan, who recently reported on the work of staff members. They stand a rat on steel strips so that it will conduct small charges of electricity through its paws. When the animal is excited or experiences high arousal, the electrical resistance is very low (supposedly because of a condition like sweating in humans). When the rat is calm, the resistance it offers to the passage of the current is high.

The difference between motivation and emotion becomes apparent as a result of changes in resistance or the lack of resistance when the animal is in different states.

"Fright on the one hand and boredom on the other produce great differences in skin resistance," says Dr. Walker. But he adds that "making the animal hungry or thirsty does not produce such changes."

The big twist comes when a thirsty rat has his thirst satisfied. In a 30-second period of drinking, says Dr. Walker, the ohmmeter that measures the electrical resistance "will record an upward swing of as much as 180,000 ohms."

. . . can now predict a baby's sex with 100 percent accuracy. Two Connecticut researchers got a perfect score with 21 babies born to mothers from whom amniotic fluid had been drawn because of suspected prenatal disease. *Medical World News*, reporting the experiment, says the specimens were centrifuged to separate the fetal cells, which were then examined for sex chromatin counts. Chromatin is a material in the nucleus of the cells. A count of three percent or less denoted a boy; a count of 12 or more, a girl.

In the case of a 22nd baby, the researchers found a count of six, neither male nor female. They made no prediction. And, unhappily, they never determined the child's sex because it was stillborn in a hospital unaware of the study.

. . . admit there's a lot we don't know about water—especially salt water. Of course, there's also a lot we do know. The subject was raised by Dr. Jerome Greyson, of Atomics International, a division of North American. The division had got a U.S. contract to study the action of salts in water so we can better turn salt water into fresh.

"Water," said Greyson, "is a queer material. According to all reasoning, it should be a gas. It is one of the few known materials that are less dense in their frozen state than as liquids. This is fortunate for life as we know it, for if ice did not float, the oceans and rivers would freeze from the bottom up and would tend to remain frozen. Fish would not survive, and plant and animal life would be affected.

"Even more complicated than water is water with salt in it," Dr. Greyson added.

We presume we will be hearing from him about *that* some day.

INVENTOR OF THE MONTH

Everything is automated but the carhop

HISTORIANS recording the automation of the drive-in restaurant in the 1960's can give much of the credit to Norman Alpert (above), *Science Digest* Inventor of the Month.

His specific contribution is Orbis, the brain and nerve center of the American Machine & Foundry Company's system. With two of his staff as co-inventors, he was recently awarded Patent 3,267,436 for the ordering, price-computing and billing machine.

An operator at the electronic computer console, receiving customer's orders from cars and tables, pushes buttons to tell the automatic hamburger machine and five other producing units what to cook and wrap, and whether it is to be eaten on the premises or taken out.

Orbis (meaning ordering and billing system) can handle some 30 different food and drink items; make price, tax and total computations; produce a bill with the customer's station number, and keep inventories. A carhop or waitress picks up the tray at an assembly station, and delivers it.

The AMFare system is the company's major new program, designed for "limited menu" restaurants with at least $200,000 annual sales. The first installation was opened last April at Jay's Brookdale Restaurant in a Minneapolis suburb. A second is under construction at Lexington, Ky., and contracts for others are pending.

Alpert is manager of the electronics division of the AMF process equipment group in Springdale, Conn. Last spring, for Orbis and other achievements, he was presented with the $10,000 Morehead Patterson merit award, named for the late chairman of the board.

The inventor got his bachelor's degree in electrical engineering from the College of the City of New York in 1945. He later taught there for two years and received his master's degree. After working for several other industrial concerns, he joined AMF in 1960. —*Stacy V. Jones*

INVENTIONS PATENTS PROCESSES

Safer X rays

A DENTAL X-ray head has been designed to minimize the potentially harmful effects of radiation scatter and to maximize the clarity of X-ray images.

Inventor Albert G. Richards, professor of dentistry at the Univ. of Michigan, reorganized the components of the ordinary dental X-ray machine to lessen the patient's exposure to radiation. The source of radiation in his device is seven inches farther from the patient than present X-ray machines.

Instead of relying on length of the radiation filter and cone to achieve a desirable distance between machine and patient, Richards recessed them into the X-ray head. The result is that there is less radiation bouncing around the room, resulting in less body exposure of the dental operator and less gonadal exposure of the patient. (The reproductive areas of the body are of particular concern.)

Dental radiographers have long recognized that longer distances between patient and X-ray machine produce clearer X-ray images. The development of the long cone made a more precise image possible, but was cumbersome to use. By incorporating the X-ray head itself as part of the cone, Richards allowed the shielded avenue through the dental head to provide length and stability for a sharper radiograph.

Rapid rinse for film

A portable film processor that develops film with a minimum of rinsing is being tested by IBM.

The device uses a "solution-bead" process, which requires only tiny amounts of solution. Plumbing is not needed. A combination of high-temperature hypo (fixer) eliminator and alkaline baths removes fixing salts without the usual extensive rinsing.

Film is threaded under locating arms before being quick rinsed in film processor.

The unique processor combines portability with "archival quality"

processing. This processing, essential for maximum film life, requires the removal of virtually all fixing salts. (No more than five millionths of a gram can be retained on a square inch of film.)

Here's how the processor works:

As the film is drawn through shallow layers of temperature-controlled solution, fluid applicators apply an even bead of processing solution to the film through a 0.005 inch slit.

Locating arms, reference plates and rollers keep the film about 0.015 inches from the stainless-steel applicators.

Six liquid applications are used: developer, fixer, hypo eliminator, alkaline rinse and two separate water baths. Flow meters, rate-control valves and electrically-actuated shut-off valves control the flow of solutions.

The processor weighs only 120 pounds, making it easy to use in remote installations, and for on-site development of equipment test films.

Revolution in rice

The first major change in rice milling since its first recorded use in 3,000 B.C., is a process that increases the yield of whole grain rice up to 10 percent over conventional milling methods.

Introduced by Riviana Foods, Inc., the Solvent Extraction Milling Process uses a revolutionary wet method for milling the rice.

Rice is the principal source of nourishment for nearly one quarter of the world's population, yet milling processes, whether by primitive mortar and pestle or sophisticated electric-powered machinery, have remained essentially the same. The outer layer of bran (the husk) has traditionally been removed by mechanical abrasion and pressure from the rice kernel, a process which tends to break the grain into small pieces which are less desirable for eating than whole grain rice.

New Riviana rice milling plant may bring about needed revolution in milling methods.

With the SEM process, the bran layer is softened first, then wet-milled in the presence of a rice oil solution. The solvent aids in removing the bran from the kernel, helps in conveying the bran away from the rice and, as a lubricant, keeps the temperature of the rice from increasing, thus preventing breakage.

Besides an increased yield of whole grain rice, the SEM milled rice is whiter, has less fat and a longer shelf life.

SEM also provides, in one continuous process, rice oil and valuable proteins from rice bran not gleaned from the grain by usual milling methods.

Rice bran, ordinarily used as animal feed, with the SEM technique is 50 percent higher in protein, virtually fat free and much more stable. The product will have uses in production of baby foods, hot cereals, cosmetics and pharmaceuticals.

Before the inaugeration of this technique, a separate operation had to be carried out to extract rice oil from rice bran. Now two pounds of the oil are produced during the normal milling process from each hundredweight of unmilled rice. Uses for rice oil range from salad oil and margarine to carnaube-type waxes and specialty paints.

Invented by Truman B. Wayne in conjunction with Riviana, the basic patent for the SEM process was issued July, 1966.

Glass rope

Rope made of a new glass fiber called Glastran is as strong as steel cable of the same diameter and almost four times lighter, according to an official of General Motors Corp., which introduced the product to the structural material market.

Glastran is made of continuous filaments of glass, impregnated with a plastic resin. These filaments are woven into strands which are then cabled together much as any conventional rope would be assembled. The finished cable is non-corrosive, has high tensile strength and its strength in proportion to its weight promises to strongarm its rivals.

First developed to help improve deep ocean mooring techniques, the glass cable can be used as guys and catenaries for antenna systems, tethering for weather and communications balloons, mooring or long hoist cable and ship safety lines.

When put on its mettle as guy members on a U.S. Coast Guard antenna tower, the Glastran cables proved lighter and more easily handled than comparable steel cables, were installed in less time and, being non-metallic, increased the efficiency and range of the station.

Metal mystery solved

Why do some metals become harder when struck while others fracture and fly apart?

The answer to how and why metals behave differently has been discovered by two engineers from Pennsylvania State University. Their new technique utilizes the electron microscope to study microthin slivers of metal to measure and predict the energy that holds metal atoms together. The discovery could stimulate the development of stronger, lighter-weight metals for the Space Age.

Essentially, the technique is

based on the idea that there is a well-defined amount of energy in a metal which is preserved during impact of a metal. This energy can be accurately measured and predicted through a series of complicated electron microscope observations and calculations.

Impacted metals show, through the microscope, clearly marked crystal boundaries. Metals like stainless steel also show distinctive patterns of fractures, very like the cross-hatching of chicken wire, which make them stronger.

According to the engineers, it is the ratio of the energy required to hold the crystals together and the energy required to hold the fractures together that determines the strength and utility of the metal.

By reading the angles between the crystals and the fractures, metallurgists and engineers will discover new and better ways of artificially strengthening metals which can only be done now, using huge amounts of input energy—such as explosive impacting or prestressing.

Antenna you blow up

An inflatable radio antenna that shoots up to a height of 60 feet and has a line-of-sight range of 25 miles, is a major aid to long-distance communications.

Manufactured by Goodyear Aerospace Corp., the lightweight antenna is constructed of a flexible, reinforced plastic-cloth fabric. When extended its full height, the mast can clear foliage, trees or any other obstacles that would absorb the signals of the conventional short-whip antenna.

The inflated antenna is connected to a portable radio by a small coaxial cable. The wire radiating element is mounted at the top of the mast and can be adjusted in length to be tuned to the desired VHF or UHF.

Sequence of antenna blow-up: in backpack and at inflated 60-foot extension.

Deflated, the mast rolls into a one-cubic-foot package along with a foot pump, hand crank, guy anchors and a repair kit. The whole combination weighs only 28 pounds. Once the mast is removed from the backpack, it can be inflated by the manually operated foot pump in about 15 minutes.

The antenna masts are seen by company officials as being a great help to U.S. armed forces communications in Vietnam.

THE MEDICAL PICTURE

First artificial heart survivor

MRS. Esperanza del Valle Vasquez has many reasons to smile. She is the first patient to recover after the implantation of an artificial heart (see "The Most Important Operation in History," July, 1966).

The 37-year-old Mexico City beautician was discharged from Houston's Methodist Hospital on Sept. 6, less than a month after Dr. Michael DeBakey installed the left ventricular bypass pump. She said she had not felt so active in years.

Mrs. Vasquez's heart had been damaged by rheumatic fever. A flareup caused her physician to refer her to Dr. DeBakey.

"The symptoms of heart failure recurred and became progressively worse," explained a hospital spokesman. "In recent years Mrs. Vasquez had not been able to walk up hills or stairs, and by the time she arrived in the Methodist Hospital in July, her condition was rapidly deteriorating."

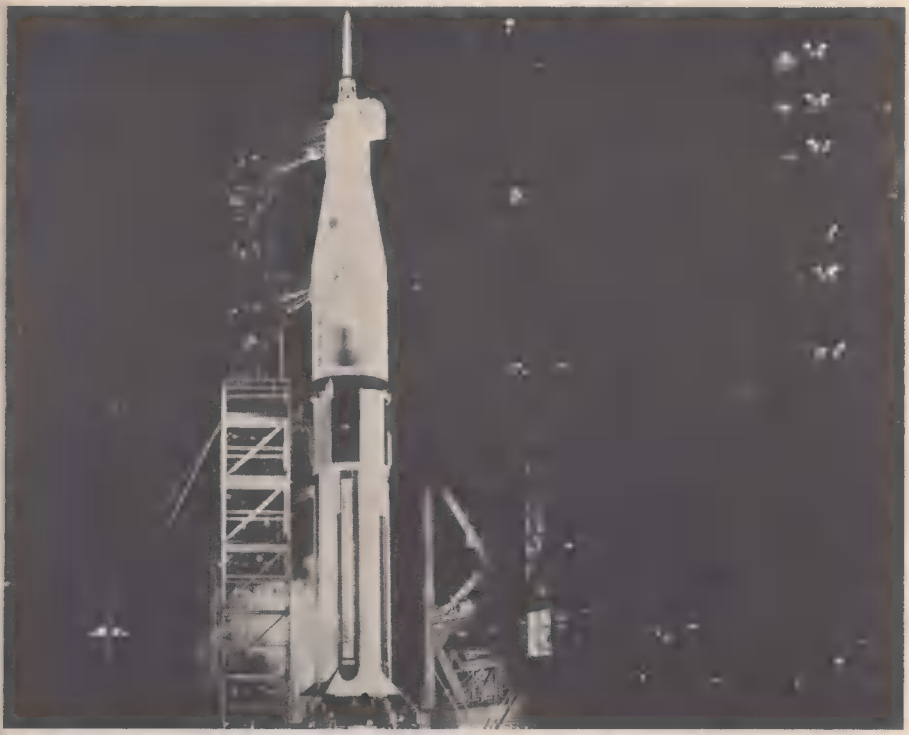
The pump was installed on Aug. 8. Twice during the 10 days it assisted her heart, the patient showed signs of worsening. When the pump's workload was increased, taking over as much as 60 percent of her heart's duties, her condition improved. The heart had time to heal, the intent of the designers.

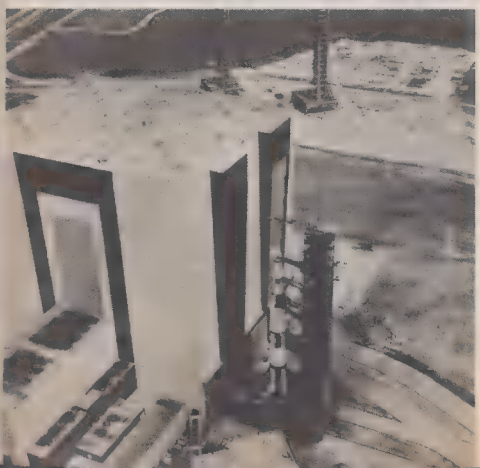
Mrs. Vasquez, a diminutive 90 pounds, was cheery as she left the Methodist Hospital.

U.P.I.

THE SPACE PICTURE

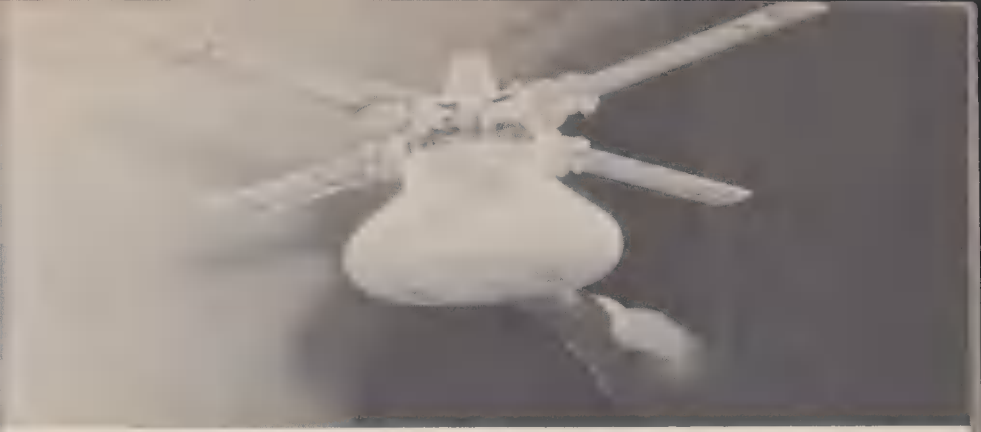
Next time for real





The Apollo spacecraft command and service modules sit atop a Saturn 1 launch vehicle in readiness for one of the moon ship's final unmanned tests. It went without incident. With the launching of Gemini 12, that series comes to an end and manned Apollo tests begin. Ultimately the Saturn 5 will replace the Saturn 1.

A 365-foot-tall test model of the Saturn 5 is dwarfed by the incredible Vertical Assembly Building at Cape Kennedy, where everything concerning Apollo is on a gargantuan scale. The test rocket will never make a flight to the moon. It has been built to verify launch facilities and develop test and checkout procedures.

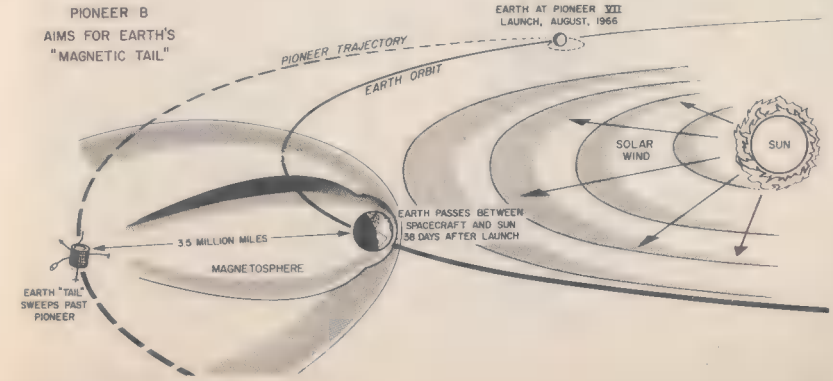


How to come down to earth

One proposed method of bringing a space vehicle back into the earth's atmosphere, currently under study, is the rotor entry vehicle. The vehicle would make a descent to earth in much the same manner as a helicopter making an unpowered landing.

Exploring space 12 million miles out

Right: Artist's conception of the Pioneer 7 satellite launched Aug. 17. Below: Diagram shows the orbit of Pioneer 7. The 140-pound craft is designed to scan a full circle in the plane of the earth's orbit. One of the most important tasks is to send back information on the earth's "tail," the part of the earth's magnetosphere that is distended into a giant teardrop shape by the strong solar wind.



Mission to the edge of space

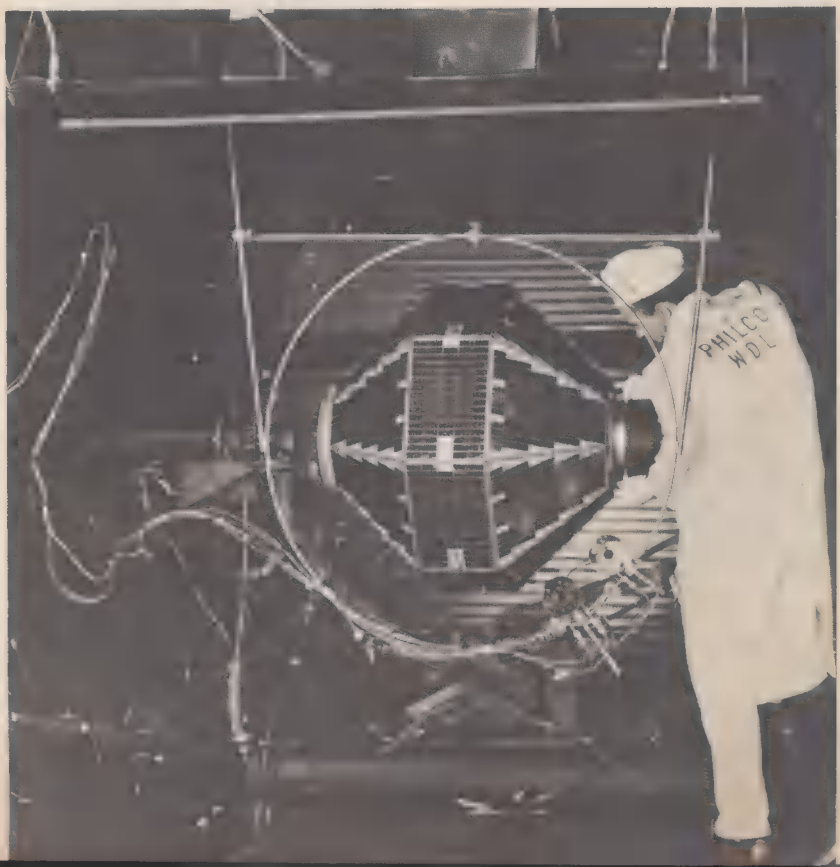
Right: On the line at Flight Research Center, Edwards, Calif., and ready for a mission to the edge of space is NASA's famed X-15 research aircraft. Equipped with external propellant tanks, the X-15 is launched from beneath the wing of a B-52. The external tanks help boost the speed of the aircraft to over Mach 6. To adjust to such speeds, test pilots must spend one hour in ground simulation for each 10-15 minutes of actual flight.

Eleven down, one to go

Astronauts Charles Conrad (shown at left) and Richard Gordon (below) were crewmen on Gemini 11, the next to last Gemini flight. Even while the pair were performing historic tasks in space, workmen at Cape Kennedy were moving the 138-foot-long first stage of the three-stage Saturn 5 moon rocket to the "moonport" at the Cape for a test launching. From now on NASA's principal attention will be focused on moon-bound Apollo program.

Lost in explosion

This military communications satellite (below) was one of eight destroyed in an explosion of a Titan 3-C rocket late in August. The $15 million vehicle erupted in an orange flash just 80 seconds after what had looked like a perfect launch. In June, an identical rocket had placed seven of the military satellites in a precise orbit.



THE COLLEGE SCENE

The coming crisis over science

AMERICAN universities today face a crisis over the role of science, in the view of Daniel Bell, professor of sociology at Columbia University.

In a book published by Columbia University Press, *The Reforming of General Education,* Professor Bell says the coming crisis on campuses will also be one pervading our entire culture.

"The university has become, at least in American life, the major focus of the intellectual," he says, "and, to some extent, the established cultural life of the country."

In short, he adds, the university is "the social institution that joins knowledge and culture."

As such, says Professor Bell, the university is the victim of what he calls a "radical disjunction between social structure and culture."

He describes the disjunction as one "expressed most directly in the two major orientations towards the future that divide the intelligentsia today — the technocratic and the apocalyptic." He adds:

"This issue, I submit, will be the source of a serious intellectual crisis in the university.

"The technocratic view distrusts ideology; emphasizes the discipline of fact; is oriented to problem-solving; and employs an increasingly powerful armory of intellectual techniques to enlarge the means for controlling nature and to sharpen the definition of the rational conduct of men.

"Its vocational meaning is summed up in the word *professionalism.* To be a professional means to belong to a guild dedicated to the advancement of the certified knowledge—and competence—that have been tested and accumulated over a great span of time."

That leads to trouble.

"Necessarily," says Professor Bell, "professionalism erodes the world of opinion, a world where each man can pass judgment on any issue by invoking, at best, the canons of taste."

There is, in short, an alienation invoked by the new world, "one shaped increasingly by engineers and economists, the riders of technology and rationality."

This alienation, says Dr. Bell, "represents the 'dispossession' of the young intellectuals whose forebears lived so vividly in nineteenth-century Russian novels . . . and who take their own sensibility and experiences, rather than reason or tradition, as the touchstone of truth.

"They abhor the remoteness and coldness of 'social engineering' and

Daniel Bell of Columbia, who foresees crisis on campus, is also a writer and editor.

prefer to create worlds of 'participation' and 'community.' In the end, however, they lack the technical knowledge, or even the willingness to acquire it, that could test their abstractions against a social reality."

Professor Bell is not so alarmed at that as he is at another threat:

"It is not 'alienated youth' that tells the whole story, for they live, sadly, in a halfway house.

"There is a deeper current of nihilism at work today, with new radical features, that is embattled against the technocratic society."

He distinguishes between the two nihilisms in these words:

"One vital strain of modern literature has always been in opposition to the direction of rationalist history. It emphasizes the subjective self as against everything outside its ken—against mind and against society. Its roots go back to the theme, vividly expressed in *Rameau's Nephew*, that art alone, but art infused with passion, speaks the truth. . . .

"But as the distance between the self and the world increased, the retreat into self became a radical nihilism, invoking terror and the demonic in an effort to transform the world."

Today's nihilism, says Dr. Bell, doesn't even pretend to serve culture:

"The extraordinary fact is that in recent years . . . nihilism has begun to attack the very core of culture and to proclaim a way of life that is really a withdrawal from society, a retreat into the 'interior distance,' a new gnostic mode which beats against all the historic, psychological taboos of civilization.

"Perhaps we are too close in time to these new styles," Professor Bell says, "and mistake what may be a passing fad for a rupture in moral temper.

"But I think not," he adds.

"The crucial line of difference is that the older modern writers, no matter how daring, constrained their imagination with the order of art.

"The post-modern sensibility seeks to abolish constraint by substituting experience for art, sensation for judgment. And it wants to impose that sensibility of undifferentiated experience upon all realms of culture. . . ."

Today's "science" engineering students

The explosion of technical knowledge in recent years has changed both the engineering profession and engineering curricula.

At Cornell University, says Donald L. Moyer, until recently Director of Student Personnel for Engineering, the curriculum "has not gone 'science' but is still teaching 'engineering.'" Nevertheless, he adds, Cornell today "accepts only students who have the capability for analysis, and who are able to cope with theoretical concepts."

Moyer, who is now assistant to the University Provost, says engineering education today includes more mathematics, physical science and engineering science than ever. This, he says, causes problems for many students:

1. It is hard to decide whether to be an engineering student or a science major.

2. As the time lag between discovery and application has shortened, the scientist and the engineer have become interdependent, and the distinction between them less obvious.

These changes have brought a change in the kind of student Cornell looks for as a budding engineer. Says Moyer:

"While we welcome any boy with a down-to-earth, practical, commonsense approach, who does things well with his hands and who enjoys working with people—all of which are earmarks of a good engineer—he must combine these characteristics with the intellectual attributes the curriculum now requires to succeed at Cornell."

Writing in a Cornell publication, *Engineering,* Moyer also makes a pitch for computerized selection of college students:

"Why not select applicants to college by means of this quick and unflinching appraisal? . . . Use of the computer is already being discussed in the inner circles of the admissions officers.

"My only comment is that much of the data now used in the selection of students could be better entrusted to a machine than to the fallibility of humans."

New at Stanford

A new kind of electronics engineer is being trained at Stanford University. Classically, electric circuits have been built by assembling discrete components such as resistors, transistors, etc. Today, small systems can be fabricated completely in a piece of semiconductor material only .001 square inch.

That means that the man working with materials—previously the device designer—now has to concern himself also with electric circuits and systems. Similarly, the systems man, previously isolated from materials, now needs to know the limitations and capabilities of

materials technology.

To meet the demand for the new kind of electronics engineer, "Integrated Circuits" is being taught by Professor R. L. Pritchard in a recently completed laboratory on the Palo Alto, Calif., campus.

The goal of the new facility: to train electronics engineers to draw on a broader and deeper reservoir of knowledge so that thinking and creating circuit systems become one process.

Crafts at R.I.T.

ROCHESTER Institute of Technology has a School for American Craftsmen that offers full-time programs with concentration in one of four craft fields:

Ceramics, including ceramic sculpture; metalcrafts and jewelry; weaving and textile design; woodworking and furniture design.

A fifth field, glass design, is being considered.

An Associate in Applied Science Degree is awarded after two successful years of study. Students with the aptitude and interest to continue are awarded a Bachelor of Fine Arts degree after four years.

Graduates of the school are leading the renaissance of crafts in the U.S. Some of them, together with qualified applicants from other colleges, are accepted for a fifth year, leading to a master's degree.

Sponsored by the American Craftsmen's Council, the school has been a department of R.I.T. since 1950.

Alan Friedman is student in woodworking and furniture at R.I.T.'s craftsmen school.

Prof. Frans Wildenhain, renowned ceramic sculptor, and Michael Twining, '66 grad.

Faculty people

Dr. O. Meredith Wilson, president of U. of Minnesota, named director of the Center for Advanced Studies in the Behavorial Sciences at Stanford U.

Prof. Ernst Mayr, director of Harvard's Museum of Comparative Zoology, awarded honorary Doctor of Science degree by Oxford U., England.

Dr. John P. Meehan appointed chairman of U.S.C. School of Medicine's department of physiology.

Dr. Jerome Spar, NYU professor of meteorology, to direct $25,500 study by School of Engineering and Science into Northeast drought.

Dr. Paul Harteck of Rensselaer Polythechnic Institute (see photo) awarded honorary degree of Doctor of Natural Sciences by University of Bonn, Germany.

Dr. Everett S. Lee, formerly of U. of Penna., appointed full professor and director of department of sociology and anthropology at U. of Massachusetts.

Prof. Donald Berry, chairman of Northwestern's department of civil engineering, elected a member of National Academy of Engineering.

Dr. Leslie A. Chambers, USC professor of biology, named head of Environmental Sciences Review Committee of National Institutes of Health.

Dr. Peter Girardot, professor of chemistry at Arlington State College, U. of Texas, appointed dean of ASC's new School of Sciences.

Dr. Paul Harteck, research professor at RPI, appears with prototype of atmospheric simulating chamber built at Rensselaer. Construction of the world's largest chamber of this type, which reproduces the upper atmosphere of planets, was recently completed at U. of Bonn, Germany.

Commander Sherman C. Reed, USN, named associate professor of naval engineering at M.I.T.

Dr. Edmund F. Ackell, chosen dean of U. of Florida's new College of Dentistry; *Dr. Vincent R. Learned,* director of Division of Sponsored Research; *Dr. Charles B. Browning,* chairman of dairy science dept.

Dr. Louis Hammett, 72, and *Prof. Ronald Breslow,* 35, given two of American Chemical Society's highest awards. Dr. Hammett taught at Columbia for 38 years until he retired in 1961. Dr. Breslow, who teaches sophomore organic chemistry at Columbia College, was honored as the chemist, 35 or under, who has done the finest research.

It happened

• An alumni directory of *Case Institute of Technology* revealed that more than one out of every 10 Case graduates is a top-level executive; 1,500 out of a total of 11,000 were shown to hold positions ranging from board chairmen to chief engineers. That's an increase of 50 percent over a 10-year period.

• *Wayne State University*, in Detroit, initiated new fee-billing procedures to permit payment of tuition on a monthly "installment" basis.

• An interdisciplinary graduate study program in biomedical engineering was established at the *University of Southern California*. Major emphasis will be in: 1. use of analytical tools, as in systems engineering, to study biological systems; 2. development of devices that simulate the function of living organisms.

• The National Science Foundation awarded *M.I.T.* a $627,000 contract to develop a computer-based unconventional library catalog. The catalog will provide remote access to a computer-controlled magnetic memory store of bibliographic information in science and engineering.

• *Caltech* conferred a Ph.D. in physics on Jean Hebb, 26, the first woman at the school to earn such a degree. Her home: Butler, Md.

• Groundbreaking ceremonies were held for the first building of the University Circle Research Center adjoining *Case Institute of Technology*. The center will be a university-industry complex in Cleveland housing some 7,000 researchers and supporting staff on 65 acres.

• *The State University of New York* at Stony Brook (Long Island) marked "the beginning" of its new Medical Center with two major selections for the faculty: Dr. Edmund D. Pellegrino as chairman of the department of medicine and Dr. Alfred G. Knudson, Jr., as professor of medicine and member of the planning team.

• After a seven-month, 17,000-mile voyage through the North Pacific, the *Scripps Institution of Oceanography* research vessel *Argo* docked in San Diego, Calif. Three Scripps graduate students helped in water and marine life studies on a track between the Hawaiian and the Aleutian Islands.

• The Graduate Engineering education System program of the *University of Florida* offered about 50 courses via closed circuit television. The courses were designed for scientists and engineers in the Daytona Beach, Orlando and Cape Kennedy areas. On the Gainesville campus, meanwhile, a four-story, $1,425,000 research complex reached completion.

• The first sustained beam of protons streamed out of the new tandem Van de Graaff accelerator at the *University of Rochester*. The event marked the beginning of research activities at the university's Nuclear Structure Research Laboratory.

TIPS AND TRENDS

THAT CIGARETTE FILTER REPORT (see page 21). Remember some brands are more effective in reducing tars and nicotine than those tested. And that the key to lung cancer in any case is thought to be the action on the lung's cylia by compounds in the gas part of the smoke. One report says Tennessee Eastman Co. of Kingsport, Tenn., is working on a new filter to reduce them.

NEW ICEBERG SPOTTERS. ESSA-type satellites are keeping a close watch on this oceanic hazard in daily reconnaissance from space.

ARE YOU PROPERLY NOURISHED? Many Americans from all walks of life are not, says the National Vitamin Foundation. And a medical nutrition expert says vitamins, minerals and amino acids are not always abundant in the foods we eat. The point is, say dietitians fighting FDA regulatory plans, that dietary supplements are often needed.

WOMEN LIKE IUD'S. At least half of women questioned in mass studies still use intrauterine devices (loops) for birth control after two years, says Medical World News.

PRENATAL MEDICINE: 1. Dr. Cecil Jacobson of George Washington U. says analysis of chromosomes in placenta months before birth reveals abnormality. 2. Dr. Cyril A. Clarke of U. of Liverpool, England, says injections of antibodies in suspected women can prevent their having Rh blood disease babies.

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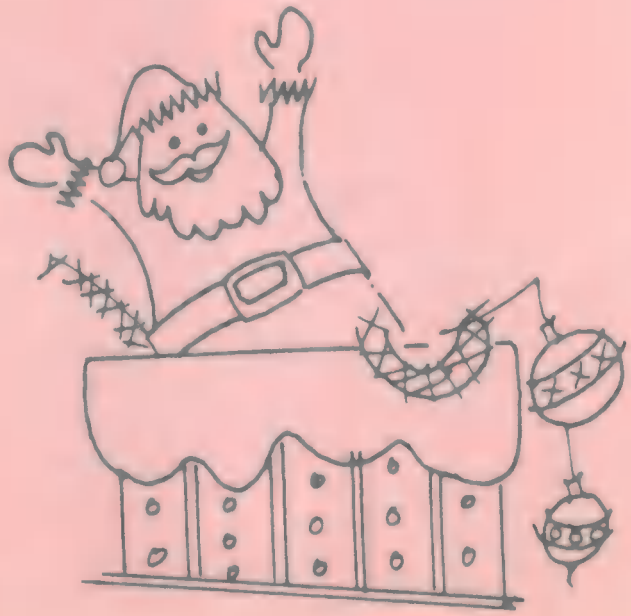

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Life detector

THE first pulse of life in a fetus can be detected by the "Doptone" Fetal Pulse Detector as early as the tenth week of pregnancy, sometimes even before the mother feels movement.

Besides discerning early fetal life, the instrument can be used to observe fetal rate and rhythm throughout pregnancy and delivery, and to localize the placenta.

Utilizing the well-known Doppler effect (change in frequency of sound waves when source and observer are in motion in relation to each other), the Fetal Pulse Detector transmits and receives ultra-sound to detect motion within the patient.

A beam of ultrasound is directed through the mother's tissue and blood from the transmitting crystal. Sound reflected from moving objects—that is, blood flowing in the vessels or in the heart—shifts in frequency and this difference is converted by the instrument into an audible sound. There is no confusion about which organ the instrument is recording because motionless structures bounce back sound of the same frequency as the sound transmitted and therefore is not heard.

Fetal life is consistently detected by the "Doptone" at 12 weeks or more, and after 20 weeks fetal pulse rate has been observed 97 percent of the time.

Nurse checks sound frequency of mother's abdomen to determine movement of fetus.

Because of the safety and accuracy of the "Doptone" detector, it offers an improved way to localize the placenta in cases of vaginal bleeding during the last three months of pregnancy. In such a contingency, it is especially important to have a differential diagnosis between placenta previa and other possible causes of bleeding.

Improved accuracy in localizing the placenta comes in the later periods of gestation, and with practice on the part of the operator. It may be possible for the instrument to get the placenta on target 85 percent of the time after 25 weeks.

This is the first instrument using the Doppler effect externally to be marketed.

The "Doptone" Fetal Pulse Detector use of ultrasound at low intensity levels has proved completely safe, with no damage to tissue or discomfort to the patient and without the hazards of ionizing radiation.

	A Little of the Time	Some of the Time	Good Part of the Time	Most of the Time
1. I feel down-hearted and blue				
2. Morning is when I feel the best				
3. I have crying spells or feel like it				
4. I have trouble sleeping at night				
5. I eat as much as I used to				
6. I still enjoy sex				
7. I notice that I am losing weight				
8. I have trouble with constipation				
9. My heart beats faster than usual				
10. I get tired for no reason				
11. My mind is as clear as it used to be				
12. I find it easy to do the things I used to				
13. I am restless and can't keep still				
14. I feel hopeful about the future				
15. I am more irritable than usual				
16. I find it easy to make decisions				
17. I feel that I am useful and needed				
18. My life is pretty full				
19. I feel that others would be better off if I were dead				
20. I still enjoy the things I used to do				

Self test for depression

A DUKE University psychiatrist, Dr. W. K. Zung, has devised a simple self-rating test which he believes is helpful in uncovering "hidden depressions" in psychiatric patients. It is called the SDS test, for self-rating depression scale.

The twenty-statement test (above) is usually administered and scored by a nurse. From the score, Dr. Zung believes the physician can get some estimate of his patients' degree of depression by comparing his score to indexes already computed for normal and abnormal groups.

The test is designed for hospitalized patients or patients who have come to a psychiatrist's office with psychosomatic disorders. But the *Journal of Iowa Medical Society* has suggested that it could be used in the general practice of medicine where most depressions are first encountered.

You can see how the test works by filling in the above form and scoring it with the key and table on the following pages.

One word of advice: If you are on a diet, the questions on eating and weight should be answered as if you were not.

As can be seen in the scored example opposite, each of the 20 items is scored 4,3,2, or 1 according to the degree of the symptom checked. The more depressed the patient,

	A Little of the Time	Some of the Time	Good Part of the Time	Most of the Time	
1. I feel down-hearted and blue	1	2	3	✓ 4	4
2. Morning is when I feel the best *	4	✓ 3	2	1	3
3. I have crying spells or feel like it	1	2	✓ 3	4	3
4. I have trouble sleeping at night	1	2	✓ 3	4	3
5. I eat as much as I used to *	4	3	✓ 2	1	2
6. I still enjoy sex *	4	3	✓ 2	1	2
7. I notice that I am losing weight	1	✓ 2	3	4	2
8. I have trouble with constipation	✓ 1	2	3	4	1
9. My heart beats faster than usual	1	2	✓ 3	4	3
10. I get tired for no reason	1	2	✓ 3	4	3
11. My mind is as clear as it used to be *	4	3	✓ 2	1	2
12. I find it easy to do the things I used to *	✓ 4	3	2	1	4
13. I am restless and can't keep still	1	2	✓ 3	4	3
14. I feel hopeful about the future *	4	✓ 3	2	1	3
15. I am more irritable than usual	1	2	✓ 3	4	3
16. I find it easy to make decisions *	4	✓ 3	2	1	3
17. I feel that I am useful and needed *	4	✓ 3	2	1	3
18. My life is pretty full *	4	✓ 3	2	1	3
19. I feel that others would be better off if I were dead	✓ 1	2	3	4	1
20. I still enjoy the things I used to do *	✓ 4	3	2	1	4
					55

SAMPLE

Sample test sheet with scoring key. Asterisks indicate questions that are worded positively. Raw score of 55 above must be converted to SDS index, in this case 69, to make a comparison with precomputed scores of normal and depressed persons.

the higher the score. Half of the 20 items are worded symptomatically positive, half, negative.

In order to get a final rating, the raw score must be converted to an SDS index by means of the conversion table at the bottom of page 56.

The normal range for SDS scores is 25 to 43, indicating that no clinically significant depression is present. The mean score for the normal controls was 33.

Depressed out-patients from mental hospitals had scores ranging from 50 to 73, with a mean SDS index of 64. Depressed patients actually in hospitals got even higher scores, ranging from 63 to 90, with a mean of 74.

Patients whose primary problem was not depression but anxiety, personality disorder or situational adjustment had a mean SDS scores of 53. However, says Dr. Zung, any score of 53 or over "may be interpreted to signify the presence of depression of clinical significance."

In devising the SDS scale, Dr. Zung constructed questions covering the most commonly found characteristics of depression. These were divided into three main groups: pervasive effect, or overall feeling; physiological equivalents, and psychological equivalents (see table, top of page 56).

Dr. Zung believes that recent studies have proved the value of his

Diagnosis of Depressive Disorders	Self-Rating Depression Scale Items	Item Number
I. Pervasive affect		
A. Depressed, sad, and blue	I feel down-hearted and blue	(1)
B. Crying spells	I have crying spells, or feel like it	(3)
II. Physiological equivalents		
A. Rhythmic Disturbances		
Diurnal variation: exaggeration of symptoms in the AM and some relief as the day goes on	Morning is when I feel the *best*	(2)
Sleep: characteristically early or frequent waking	I have trouble sleeping at night	(4)
Appetite: decreased food intake	I eat *as much as* I used to	(5)
Weight loss: associated with decreased food intake, or increased metabolism and decreased rest	I notice that I am losing weight	(7)
Sex: decreased libido	I *still enjoy* sex	(6)
B. Other Disturbances		
Gastrointestinal: constipation	I have trouble with constipation	(8)
Cardiovascular: tachycardia	My heart beats faster than usual	(9)
Musculoskeletal: fatigue	I get tired for no reason	(10)
III. Psychological equivalents		
A. Psychomotor activities		
Agitation	I find myself restless and can't keep still	(13)
Retardation	I find it *easy* to do the things I used to	(12)
B. Ideational		
Confusion	My mind is *as clear as* it used to be	(11)
Emptiness	My life is pretty *full*	(18)
Hopelessness	I feel *hopeful* about the future	(14)
Indecisiveness	I find it *easy* to make decisions	(16)
Irritability	I am more irritable than usual	(15)
Dissatisfaction	I *still enjoy* the things I used to	(20)
Personal devaluation	I feel that I am *useful and needed*	(17)
Suicidal rumination	I feel that others would be better off if I were dead	(19)

1. Zung, W.W.K., M.D.: A Self-Rating Depression Scale; Arch. Gen. Psychiat. 12:64 (Jan.) 1965

2. Zung, W.W.K., Richards, C.B., and Short, M.J.: Use of the Self-Rating Depression Scale in an Out-Patient Clinic: Further Validation of the SDS. To be published.

Table shows relations of different types of depressive symptoms to SDS scale items.

simple test as a diagnostic tool.

In his opinion, it is the test's very simplicity that makes it particularly useful. It helps not only the doctor, who is relieved of the task of administering a lengthy and complicated test, but also the patient, who may already be depressed, apathetic and having psychomotor difficulties, thus being a poor subject for an extended period of concentration.

Table to convert your score to SDS index.

Raw Score	SDS Index	Raw Score	SDS Index	Raw Score	SDS Index
20	25	40	50	60	75
21	26	41	51	61	76
22	28	42	53	62	78
23	29	43	54	63	79
24	30	44	55	64	80
25	31	45	56	65	81
26	33	46	58	66	83
27	34	47	59	67	84
28	35	48	60	68	85
29	36	49	61	69	86
30	38	50	63	70	88
31	39	51	64	71	89
32	40	52	65	72	90
33	41	53	66	73	91
34	43	54	68	74	92
35	44	55	69	75	94
36	45	56	70	76	95
37	46	57	71	77	96
38	48	58	73	78	98
39	49	59	74	79	99
				80	100

© William W. K. Zung, M.D., 1966.

Another positive feature of the test, according to the Duke psychiatrist, is that the scoring is objective and not based on interpretation by the interviewer.

Dr. Zung notes that repeated use of the SDS test confirms that sleep disturbance is one of the main symptoms in depression. This is also the symptom that patients feel improves most after treatment.

He believes that the test "is valuable in documenting and quantitating initial symptoms and complaints, and following changes in the patient's clinical course subsequent to treatment."

Dr. Zung noted that in one study 31 patients who had high SDS scores were all later diagnosed to be suffering from depressive disorders. After treatment, the scores of these depressed patients dropped to near that of the normal controls who showed no significant depression.

K.F.S.

Capt. Eddie Rickenbacker still looked cheerful after he and six companions spent three weeks lost on a raft in the middle of the Pacific Ocean. Experiences like Rickenbacker's give insight into why some people manage to live through a disaster and others don't.

The anatomy of survival

by Eileen Crimmin

THOSE who live uneventful lives have little conception of what happens when a person, or a group, is plunged into a sudden, exhaustive fight for life.

Even those living eventful lives often are only vaguely aware of the changes, forces and fallacies that arise during that stunningly swift alteration of normal circumstances to a strange, threatening situation.

Man has fashioned his environment to protect, sustain and comfort him. When this environment is removed abruptly, his physical deprivation is serious, but his emotional and psychological deprivation is critical.

Virtually no standard, ethic, principle or concept that functions in normal living fits you for emergency or disaster survival. Generally, a survival situation dumps us back several million years to an elemental struggle between Man and Environment.

Suddenly money, position, skills, knowledge—all painstakingly acquired and useful in modern life—mean little or nothing. The realization of this is more than painful. It's profoundly shocking, sometimes

to the point of driving persons out of their minds temporarily or permanently.

How you finally react to your jeopardy generally depends on whether you have been active or passive in normal life.

Survival qualities

Do you "just get by" at work, or are you the boss? Are you a parasite living off the ideas of others, or are you the one who creates these ideas? Do you believe that something or somebody will take care of you, or do you believe it's your job to take care of yourself? Do you believe others are truly kind, good and helpful, or that this is simply a veneer of civilization designed to promote self-interest and expedite group interest? Do you merely "exist" or do you "live"?

This is the final article in a series of seven on how to survive disasters, natural or man-made. Author Eileen Crimmin, who has discussed everything from earthquakes to air crashes, here gives the general rules that will help the victim of any sort of catastrophe stay alive until help arrives.

Survival studies show that certain characteristics are common to all survivors. They are stubborn, determined, even fanatical about staying alive. They struggle to control their new environment. They create activity, work and play, even to the point of making a fetish of creating diversion and distraction. They are aggressive against their situation, but not aggressive against themselves or others in the party.

They are as good to themselves as circumstances allow—they have a sense of personal worth and are not self-haters. They accept their situation as an impersonal circumstance and have no feeling that "something" or "somebody" is picking on me."

No accurate prediction can be made about who will triumph in a survival situation. But odds favor those with reasonable or detailed knowledge about their environment, emotional stability, a healthy body, sound ego and history of active participation in normal living.

Passive, apathetic, fearful individuals seldom make it. Also, an injury, either minor or major, lessens survival chances.

However, so decisive a factor is one's strength of will that often a person of strong will with a major injury will survive when an uninjured person or one with a weak will succumbs!

In all the fascinating factual accounts of human survival, there is one common denominator—the will to live. No matter how different the circumstances, how diverse the threats to existence, or how prolonged the ordeal, those who survive possess a fierce determination to stay alive.

This determination, which amounts to an utter refusal to give in and die, ultimately, and in some cases, almost miraculously, sur-

To survive an ordeal, you must have the stubborn determination to live.

mounts all obstacles to living.

It is well documented that "give-upitis" rather than actual death-producing situations kills most victims. We know this because so many die in relative comfort, good physical condition and with much sustaining equipment, food and water!

It is well documented that determination to survive is not directly transferable, though a strong leader can do much to prolong life. Consider the 23-day ocean ordeal of Eddie Rickenbacker and party when the indomitable Rick, by using every psychological and mental device at his command from group singing to curses, outright threats and deliberate bullying, would not allow his party to give up.

Leaders and the led

In group jeopardy, leaders emerge. This leader may not be the one in command prior to the survival situation. Nevertheless, all survival leaders confront similar problems.

Following a disaster, roughly 12 to 25 percent of the victims remain calm. Another 10 to 25 percent are impossible—hysterical, fainted, rigid, etc. The remaining approximately 50 to 75 percent will be in shock, confused, often bewildered, but over all fairly quiet and responsive to simple orders.

The majority of victims will prefer to take orders, not give them. The end of shock is announced when victims become verbal, even garrulous, about their recent harrowing experiences. The beginning of monotony arrives when petty bickering occurs. The forerunner of apathy and depression is nostalgia, which must be avoided at all costs.

The leader must tell his group the truth about their situation at all times—put diplomatically and hopefully—by informing them of how well off they are and how badly off they could be. (When they possibly become that badly off, he must invent even worse tales!)

A leader must strive to maintain and create positive emotions—joy, anger, etc.—and avoid, reject or surmount negative emotions—fear, hatred, sorrow, etc.

Although the group leader, and others amid the group, can affect profoundly each individual's desire to survive, the final decision to stay alive remains a private one. When in jeopardy alone, of course, nobody but you decides whether you will survive.

Whether a victim's survival stamina is aided by religious beliefs is a moot point. There are records of survival credited to firm belief in a Supreme Being. There also are records of non-survival when a victim felt deserted by a Being previously serviceable and sustaining in normal life! Perhaps it depends

upon the *quality* of belief held by a victim.

At any rate, some religions teach passive acceptance of one's fate. In survival situations such acceptance must be nicely counterbalanced with a desire that one's fate is to live!

Consider the following favorite survival story: An old sea captain was adrift in a dory with a chaplain. The elements were unkind and after several days the chaplain died. The buffetted old skipper lived on many days more and ultimately was rescued. When he was able to discuss his ordeal, he was asked why he thought the chaplain succumbed so quickly, indeed, at all. The skipper puzzled a while then suggested that perhaps the chaplain was ready to die but he, the skipper, damned well was not!

Principles to live by

If you, too, are "damned well not" ready to die if confronted by a survival situation, you can strengthen that resolve by reading at least two of the many books about the subject: "The Art Of Survival" by Cord Christian Troebst; and "The Will To Live" by Arnold A. Hutschnecker, M.D.

Here are a few of the principles for survival in any emergency situation, from a plane crash to a serious disease.

1. **Don't give up.** These words provide mental stimulus designed to strengthen emotional attitude. Note that they comprise the first, most important rule of survival. Without this attitude, it doesn't matter how much help you have in the way of equipment, personnel, shelter, food, etc. Without this attitude, you're in bad shape even when you're in good shape.

2. **Remain optimistic.** Regard your situation as a challenging adventure that, as in the movies, will turn out all right.

3. **Help yourself first.** Help others when, and if, you can. This apparent selfishness, repeated in previous articles, may offend some readers. But experience teaches that if survivors who are mobile and clear-headed will care for themselves first and get out of the way, those victims unable to help themselves can be more quickly rescued, helped and cared for.

4. **Keep your wits.** Don't panic. Avoid panic-stricken individuals.

5. **Get busy.** Set up a series of obtainable goals directly involved with your immediate surroundings and circumstances.

Goal 1: Inventory all equipment, gear, clothing, food, liquid, personal effects, etc.

Goal 2: Inventory physical and mental skills you possess, or possessed by entire party.

These inventories serve two purposes. They are familiar activities which help restore normal work, eat, rest and play schedules. Re-establishment of normal living rhythms helps overcome shock and fear. These inventories tell you, right to the last zipper, hairpin and button, what tangible items are available to

aid you in a tenacious fight for survival.

Goal 3. Find or build shelter.

Goal 4. Determine how to distribute available water, or how to obtain it.

Goal 5. Decide how to distribute food, or how to obtain it.

Goal 6: Find or make signaling devices to attract rescue.

Goal 7: Outline chores necessary to accomplish previous six goals. Schedule jobs. Organize work shifts.

Goal 8: Refine all foregoing goals and add others as circumstances alter. Depending upon the situation, life activities of survivors deliberately can be made complex, even sophisticated. You must avoid monotony which is the first step toward apathy.

6. **Think.** As part of each "play" or "recreation" period, probe the mind to recall everything seen, heard or read about survival and the particular situation you're in. Whenever suitable, apply such information.

7. **Attend to morale.** Capacity to survive is directly proportionate to high morale. Cultivate cheerfulness, hope, confidence, optimism, buoyancy and reassurance. Invite anger because it is a healthier reaction than depression or apathy. Curse your circumstances, but not yourself. Never allow frustration to become apathy, apathy to become depression, depression to sink into despair and despair to allow you to accept death.

People who fight to live, live. Those who accept death, die.

Why Do You Read So Slowly?

A noted publisher in Chicago reports there is a simple technique of rapid reading which should enable you to double your reading speed and yet retain much more. Most people do not realize how much they could increase their pleasure, success and income by reading faster and more accurately.

According to this publisher, anyone, regardless of his present reading skill, can use this simple technique to improve his reading ability to a remarkable degree. Whether reading stories, books, technical matter, it becomes possible to read sentences at a glance and entire pages in seconds with this method.

To acquaint the readers of this publication with the easy-to-follow rules for developing rapid reading skill, the company has printed full details of its interesting self-training method in a new booklet, "How to Read Faster and Retain More" mailed free to anyone who requests it. No obligation. Send your name, address, and zip code to: Reading, 835 Diversey Parkway, Dept. C-788, Chicago, Ill. 60614. A postcard will do.

The magnetic personality of matter

By Bruce Shore

To the uninitiated, scientists discussing the magnetic personality of matter may sound like a crowd at a rummage sale. Their conversation is larded with enthusiastic references to bottles, mirrors, tapes, saws, loudspeakers, cores, yokes, door fasteners and a mélange of other seemingly drab and half-forgotten clutter to be found in any attic or basement. Such common terms take on uncommon meaning, however, when employed by specialists in the newly awakened field of magnetics.

The "bottles" and "mirrors" are not physical objects but magnetic fields so powerful, they will contain the hot electron-proton plasmas currently used by scientists in their effort to achieve controlled thermonuclear fusion. If they succeed, man will have a new and virtually inexhaustible energy source at his command.

The "tapes" are also magnetic — iron oxides bound in synthetic resins and gathered on reels. Stored on these tapes are the color and black-and-white images of much of current television programming, the symphonies and chorales of modern stereophonic sound systems, and the staccato "ones" and "zeros" of new computers and data processing equipment.

Video tape (which records TV pictures magnetically) is coiled in pan of ferrite, magnetic substance that makes it work.

The "saws" are a new wrinkle— pulsed magnetic fields so intense they literally drive atoms from the materials set before them, leaving behind ragged fissures much as a saw would do.

Reprinted with permission from *Electronic Age* published by the Radio Corporation of America. © 1966 by RCA.

Loudspeakers for reproducing sound, ferrite cores for storing information in the memories of digital computers, ferrite yokes for guiding the electron beams that sketch the pictures on your television screen, the alnico fasteners that pull your cupboard doors shut—these too are magnetic. So are key parts of the doorbell and the telephone, the electric motor and the dynamo, the radio and the electron microscope. Everywhere, in fact, magnetism and magnetic devices are enriching people's lives.

There are two principal reasons for this. First, the success of modern atomic theory in explaining the sources and consequences of magnetism in matter has given man the means to produce and apply this protean phenomenon in a growing variety of ways.

Second, because of the little-known labors of J. L. Snoek and a team of Dutch scientists who managed in the early 1940s to conduct a series of investigations into the nature and magnetic behavior of ferrites, there now exists a chemistry that enables scientists to produce a class of substances whose magnetic properties are almost completely controllable.

Not that magnetism was unknown or unused until this time. Recognition of its existence goes back at least 3,000 years to ancient China and to the vanished kingdom of Magnesia, formerly in Asia Minor, from whose name the term "magnetism" is probably derived.

The first instrument known to employ magnetism—the compass—was in use by navigators on the China Sea in the 11th century and, on the other side of the world, was first described by the French crusader Peter Peregrinus of Maricourt in 1269. Peregrinus also fathered the concept of magnetic poles.

Still later, in 1600, Sir William Gilbert, physician to Queen Elizabeth, published a famous treatise on magnetism in which he suggested for the first time that the earth itself is a huge bar magnet.

In short, the magnetic effects of attraction, repulsion, and orientation (the compass) were well known and in limited used by the end of the 16th century. None of this helped to explain what magnetism is or how it is produced, however. Even the discovery by Michael Faraday, in 1831, of electromagnetic induction—the principle by which a varying magnetic field can be made to initiate an electric current in a conductor or vice versa—only succeeded in producing still another, albeit profoundly valuable, effect.

It is only in the past 100 years, with the recognition of the electromagnetic nature of light, the formulation of modern atomic theory, the discovery of the electron and the development of quantum mechanics, that scientists have begun to unravel this mystery.

It turns out that magnetism is as fundamental to the fabric of the universe as the quantities of mass, electric charge and gravitation. All the basic building blocks of matter

Increased use of magnetic substances has sparked today's electronic revolution

—the electron, the proton and the neutron—have magnetic poles and join magnetically (as well as other ways) to form the atomic elements from hydrogen to uranium. In doing so, furthermore, they usually join in such a way that the north pole of one is opposite the south pole of the other in an inverted or antiferromagnetic posture that causes their tiny magnetic fields or "moments" to cancel completely. Virtually all atomic matter is bound this way, as is all molecular matter, including that composing plants, animals and man himself.

Ferromagnetic behavior

The reason for the "anti" designation is that a handful of metallic elements—iron, nickel, cobalt, and the rare earths dysprosium and gadolinium—were the first substances to be classified according to their magnetic properties, and their atoms all proved to be exceptions to the above rule; that is, they combine "ferromagnetically" with north pole opposite north pole and south pole opposite south pole. Thus, instead of canceling, their magnetic moments add together cumulatively. Though few in number, these materials or combinations of them make the strongest magnets. For a long time, these were the only materials thought to display magnetic behavior.

In the early 1930s, however, a new class of magnetically active materials called ferrites came under investigation at the research laboratories of the Phillips' Gloeilampenfabrieken in Holland, one of the world's largest electronics companies. It was as part of this effort that J. L. Snoek and his co-workers made their momentous findings during World War II.

Ferrites are "ferrimagnetic" substances; that is, they contain several atoms of unequal magnetism coupled antiferromagnetically in a distinctive pattern—called a spinel structure. This pattern repeats as the volume of the material grows, just as in the case of the metal links that make up a piece of mesh or chain mail.

Since the magnetic atoms of such patterns or "links" do not completely cancel, because of their uneven magnetism, the "links" have a net moment and, therefore, so does the material as a whole.

Electronics revolution

Without qualification, it is these and similar materials—iron oxide compounds, in general—that have kindled today's much publicized electronics revolution. Lacking these materials, the development of television, computer memories, audio and video tape, radar, and VHF, UHF, and microwave radio com-

munications would have been greatly hampered, if not prevented.

There are several reasons for this. For one, ferrites are electrical insulators. They can be used to sense and process radio waves oscillating at up to 100 million cycles per second without sustaining the prohibitive electrical losses associated with the only other materials that have been tried in this job—the ferromagnetic metals. For another reason, even in bulk form, their north and south poles can be reversed easily and completely by the application of very small outside magnetic fields. This is what gives them the ability to store and process computer information in binary form.

In microscopic, needlelike particles, too, ferrites can be frozen into plastic binders where they will still respond magnetically to the application of an outside field by altering the direction of their internal fields. This is the basis for their use in magnetic tapes.

In yet another form, they make good permanent magnets, light enough to hold papers or other items to an upright metal surface without falling of their own weight. Also, because ferrites are really ceramics and are derived from abundant materials in the earth's surface, they are extremely cheap to manufacture.

The differences between ferro- and ferrimagnetism are not intrinsic but originate in the divergent atomic mechanisms by which each is produced.

All atomic magnetism arises from the existence, in certain atomic orbits, of electrons whose inherent magnetism is not canceled by antiferromagnetic coupling to other electrons. There are approximately 25 elements in nature whose atoms incorporate such unpaired electrons.

Since none of these atoms is able to neutralize its magnetism or magnetic moment internally, for reasons implicit in the quantum mechanical building codes that govern their fabrication, they attempt to do so by going outside.

The ferromagnets are crystals built from atoms of equal magnetism assembled into tiny magnetic cadres or "domains", like soldiers in a parade square. Since all the members of the domain "face" in the same direction, magnetically speaking, their moments add together to give the domain a cumulative moment.

Cancelled "moments"

Like a parade square, too, such a domain cannot keep adding "atomic soldiers" forever. Eventually, it reaches an optimum size, stops growing, and a new one is started. The members of the new one will "face" in a different direction, however, and those of the next in yet another until, as a result, all domain moments will effectively cancel each other. Thus, iron, fresh from the mine, seems nonmagnetic.

Ferrimagnets, on the other hand, are crystals built from atoms of unequal magnetism assembled into domains in an antiferromagnetic

Scientists can arrange atoms in different patterns to "tailor" magnetism

pattern—again like a parade square, but this time with columns of atomic soldiers facing alternately front, rear, front, rear. Ordinarily, this arrangement would cause all atomic moments to cancel. However, those columns facing front have greater magnetism than those facing to the rear, so that a net moment for each domain develops and adds to that of every other domain. To neutralize such moments, ferrimagnetic materials such as ferrites arrange to balance them off against each other just as the ferromagnets do.

The instant either ferromagnets or ferrimagnets are subjected to an outside magnetic field, though, the magnetic moments of all their domains fall immediately into line and their true magnetic character manifests itself by the appearance of a collective moment for the material as a whole. When the outside field is removed, however, the domains reassert their independence and this collective moment begins gradually to decline.

There are many more forms of magnetism, of course. For example:

- Nuclear magnetism, which has led to such devices as proton magnetometers used by archaeologists to detect the presence of buried civilizations.
- Paramagnetism, a dilute kind of ferromagnetism that has been used to help cool materials to within a few thousandths of a degree of absolute zero.
- Metamagnetism, exhibited by a few substances that are antiferromagnetic at one temperature and ferromagnetic at another.
- Diamagnetism, which derives from the orbital motion of the electron and not its internal nature.
- Electromagnetism, which is created by the flow of electrons in a conductor or superconductor.

Shifted chemically

But, to the electronics scientist, it is ferrimagnetism that holds the greatest fascination. This preference springs largely from the fact that in ferrimagnetism several different atoms arranged in a distinct and repeating pattern are involved. Therefore, it is possible chemically to shift them around within the pattern, to substitute other atoms for them, to isolate them one from another, and, in a word, to "tailor" the magnetism of the pattern with precision.

From curiosity to compass to computer memory, magnetism has moved through the centuries from the periphery of human affairs to the center of some of our subtlest scientific and finest technological achievements.

I prescribe . . .

. . . for headaches

by Joseph D. Wassersug, M.D.

OBVIOUSLY, you don't treat a headache caused by a brain tumor the same way you do a high blood pressure headache or one due to "nerves," migraine or meningitis.

The causes of headache range all the way from *acromegaly* to *West Nile fever* and the medicines vary from *aspirin* to *Wigraine*. The headache victim may also need surgery, physiotherapy, antibiotics, analeptics and a variety of other treatments for relief or cure.

Although some experts classify headaches into 15 major categories, I prefer their classification into 12 types (see box, next page).

Let us say, first, that most minor headaches may not fall rigidly into any of the classes discussed. Headaches that are caused by too much eating, smoking, drinking, transient anxieties or inadequate sleep often pass over either with mild analgesics or with no treatment at all. The success of so many popular headache-relieving medicines is due to the fact that the patient would improve almost as promptly without them. Medicines always work best when the disease is self-limited.

In spite of all that has already been written on the subject, *migraine headaches* still remain the least understood by the average person. To the layman, any old headache that is severe or is accompanied by nausea or vomiting is migraine. This is not so! Migraine is a special kind of headache, and it responds best to a special kind of treatment. A typical migraine attack may begin with a spectacular display of zig-zag lights, to one side of the eye or the other and be followed quickly by nausea and a one-sided headache located, most often, near or behind the same eye. The headache may be so intense as to force the patient to bed and, after a nap, there may be partial or complete recovery.

For migraine, I prescribe one of several ergot preparations. Doctors believe that migraine results from a sudden dilatation of one of the blood vessels going to the side of the head. Ergot, a drug derived

This is the second in a series of articles telling how a doctor prescribes for his patients' most common ills, in light of modern medical knowledge.

from a fungus, causes a contraction or spasm of such blood vessels and overcomes the dilatation, thus restoring normalcy.

When combined in a tablet with caffeine, the effectiveness of the ergot is enhanced. This combination has been modified by the original manufacturer and a host of imitators so that it can be taken by injection, by suppositories, by inhalation and by tablets that do not have to be swallowed, but can be dissolved under the tongue. Ergotamine tablets can be prescribed in mixtures that also contain phenobarbital, aspirin and many other ingredients.

Since the prolonged or excess use of ergot can constrict blood vessels and damage circulation, I give my patients a printed set of instructions indicating proper use. Furthermore, I encourage the patient to take his medicine early, at the first sign of an attack, since early treatment may prevent a severe headache.

Another medicine, a synthetic serotonin-antagonist, recently touted for its value in preventing migraine when taken on a daily basis, has been widely questioned because of the high incidence of side-effects.

Cluster-type headaches resemble migraine in that they are intermittent and usually one-sided. Some experts suspect that they are not a distinct class but simply a migraine variant. Unlike migraine, however, the cluster headache is more common in men than in women and is likely to be accompanied by one-sided nasal stuffiness and tearing of the eye. It is called "cluster" headache because doctors do not know the cause; they only know that the attacks come in "clusters" with many attacks at one period of time and a long, free, no-headache interval between the attacks.

Sometimes cluster headaches are called "Horton's Syndrome," because it was Dr. Bayard T. Horton of the Mayo Clinic who more than twenty years ago first described their special features. He believed that the headaches were due to a sudden release of histamine by the tissues of the body and he devised a method of injection treatments to "desensitize" a patient to histamine.

Some doctors still claim that these involved and costly injections

12 types of headaches

1. Migraine-type headaches
2. Cluster-type headaches
3. Muscle-contraction or tension headaches
4. Nasal and sinus conditions
5. Nervous and emotional types
6. Headaches from fever and systemic infections
7. Headaches due to various poisons and intoxications
8. Headaches due to brain tumors and abscesses
9. Headaches caused by inflammation within the brain, such as meningitis and brain fever
10. Blood pressure headaches
11. Headaches due to eyestrain and to disorders of the ears, teeth and sinuses.
12. Headaches of neuritis and neuralgia

Tension headaches can be relieved by kind words or money in the bank

are beneficial, but I have my doubts. If excess histamine were the real cause of these headaches, antihistamines should be spectacularly effective. The truth is that neither weak histamine injections nor antihistamine tablets are particularly good. Best results, I believe, are obtained when strongly sedative antihistamine tablets are used in conjunction with the salicylates (aspirin and such). The sedative effect of such antihistamines induces relaxation and sleep, and thus promotes relief.

Stress causes tension

Tension or muscle-contraction headaches differ from the others both in their causation and treatment. When a person is under stress, the muscles in the back of the neck contract defensively (presumably so that the head won't be knocked off should a battle follow) and this results in a sensation of tension in the back of the head and neck. Since may of the nerves that go to the scalp (and even to the brow) come from the spinal column in the back of the neck, any tension irritates these nerves and, consequently, a tension headache is felt mostly in back, but may also extend quite far forward. With tension, of course, other muscles are "set." too, such as the muscles of the jaw and the fists.

Persons with tension headaches can often be "taught" to relax, especially if the doctor explains to them how the headaches come about. Tension can be relieved by medicines, but it also can be helped by a few kind words, a vacation, a hot bath, a back-and-neck rub and even money in the bank.

For tension headache, I usually prescribe some muscular relaxant and a salicylate, although almost any sedative or tranquilizer might work just as well. Most of the popular relaxants today are meprobamate derivatives (Soma or Rela) or simply meprobamate (Miltown or Equanil). Other muscular relaxants are known by trade names such as Parafon, Norflex, Robaxin, etc. Salicylates are medicines related to aspirin. In mild cases, I prefer the meprobamate derivatives.

Sometimes the muscle contraction or tension headache is due to some arthritis or abnormality of the neck bones. In these cases X-ray diagnosis may be helpful. Medicines, by themselves, may prove rather ineffective; the patient may get more relief from cervical traction. The usual traction gadget costs about fifteen dollars, but a home handyman can build a suitable device for much less. A traction device stretches the neck, takes the strain off the muscles and bones. If arthritis is a prominent feature, I may also use such medicines as

cortico-steroids, phenylbutazone or indomethacin. Sometimes I need the help of an orthopedic surgeon or a neurologist. If I think I need a consultant, I get one.

What about *nasal and sinus headaches?*

In trying to self-diagnose their own headaches, most laymen (at least in my practice) attribute their symptoms to "colds," nasal conditions, or "sinus trouble." Actually, acute or chronic sinusitis is not commonly a cause of headaches, although it is true that pain in the face and forehead may result from inflamed sinuses. Such "headaches" are usually worse in the morning, worse lying down and may follow a cold (watery eyes or blocked or running nose). Chronic sinusitis may also result from smoking.

Antihistamines help

When the sinuses are blocked, adequate drainage can usually be established by treatment with antihistamines and nasal decongestants, sprays or drops. If your doctor prescribes nose drops, ask him to show you how they should properly be used. When taken correctly, they are quite effective; otherwise, they may be a waste of money and effort. Personally I prefer nasal sprays since there is less likelihood of error in administration. Simple sprays such as ephedrine or Neosypnephrine are usually as good as the more complicated mixtures.

Since antihistamines are so effective by mouth, I only rarely use them in sprays. The choice of an antihistamine is important since some can cause drowsiness and some are effective for longer periods of time than others. If the drowsiness is not too bothersome, it may be overcome by drinking a cup of coffee, or the antihistamines can be combined with a cerebral stimulant such as one of the amphetamine drugs.

Most often sinus headaches can be relieved simply by antihistamines and salicylates. If significant infection accompanies or complicates the sinus blockage, I administer an antibiotic tablet such as penicillin or erythromycin. Antibiotic injections may work a little faster than tablets in some cases, so I use them once in a while, too.

My treatment of *nervous and emotional headaches* ranges all the way from frank discussions and reassurance to psychiatric consultation and electric shock therapy. There are mild nervous disorders and severe nervous disorders and there are all kinds and strengths of nerve pills.

Since nervous patients can also have some organic disease such as high blood pressure, sinusitis or eyestrain, I believe that the nervous patient should be examined at least as thoroughly as patients with other illnesses. If the problem is only emotional, I try to evaluate its severity, and prescribe the mildest sedative or tranquilizer that may be appropriate. If the patient is also depressed, I may use one or a combination of antidepressant drugs. If

Acute or chronic sinusitis is not a common cause of headaches

the patient fails to respond promptly, I usually refer him to a psychiatrist for additional investigation and treatment. In some of these cases, electric shock therapy works wonders.

For *headaches that accompany infection and fevers,* what the doctor does depends on how high the fever is and how life-threatening the total situation might be. For example, if a patient has a severe pneumonia with a temperature of 104° or 105°, the doctor may want to hospitalize him and apply ice packs to his head, give alcohol sponge baths to his body and use intravenous fluids, etc. If a patient has an ordinary cold and is sick at home with a temperature of 99°, the doctor may simply recommend plenty of fluids and two aspirin tablets every four or five hours.

The treatment of headaches due to infection, therefore, depends on diagnosis and treatment of the underlying disease.

For persons who are sensitive to aspirin and get an upset stomach or a rash from it, acetaminophen tablets or liquids can be used to relieve the headache and lower the fever. Aspirin can also be given rectally to those who cannot take it by mouth; for example, if the patient is unconscious. There is hardly a fever or infection headache that the doctor cannot control nowadays in one way or another.

I shall not go through the whole list of twelve kinds of headaches and detail the treatments of each kind. Some are obvious. For example, a *headache from a brain tumor* ordinarily requires surgery. A *headache from meningitis* means finding the infecting microbe and using the appropriate antibiotic. *Headaches of eyestrain* are best corrected by well-fitting eyeglasses. *Neuritis and neuralgia headaches* are so varied that a book could be written about this subject.

A few words should be said, however, about *high blood pressure headaches.* These may come on at any time of day but are usually worse when arising in the morning. Contrary to popular opinion, the severity of the headache is not related to the height of the pressure. Many patients run pressures over 200 and have no headache at all, while others with pressures of 160 or even less find no relief. The most significant characteristic of a high blood pressure headache is its persistence and its failure to respond to usual home remedies.

On the other hand, the high blood pressure victim may obtain striking relief from his headache when the blood pressure is lowered. In most cases, this can be done by medicine, but some cases require surgery on the kidneys, renal arteries or adrenal glands. A thorough medical work-up may be necessary.

THE MAN DR. LEAKEY DUG UP

The teachings about man's mysterious beginnings have been tossed into disorder since Dr. Louis Leakey and his wife dug up a "cousin" of man who lived close to 2 million years ago. Their latest find has started a hot scientific debate. CBS-TV will highlight their work in a special November 5.

by Jeanne Reinert

You know your grandparents and great-grandparents were *Homo sapiens* (modern man), but just how far back can man's family tree be traced?

The findings of the last six years and new dating techniques have turned man's prehistory topsy-turvy. The old beliefs may be wrong by thousands of years for the first artifacts of civilization such as houses, calendars and villages. They could be wrong by millions of years for the very first sign of men.

Evidence for pushing back the dawn of our beginnings piles up in little heaps from many different expeditions, each one collecting pieces in the cold and scattered trail of man's evolution.

Textbooks say that about 30 to 33 million years ago a long-armed, gibbonlike creature called *Propliopithecus* became the first step toward man.

Another major change occurred about 25 million years ago, when tooth features special to man and great apes appeared on *Proconsul* (discovered in Kenya in 1928 by Mrs. Louis S. B. Leakey). This primate had much in common with creatures that spread from Europe to the Far East, as well as through Africa, for about 10 million years.

Proconsuls were followed by the immediate predecessors of man. One, *Paranthropus,* was a vegetarian. The other, *Australopithecus,* was a hunter and the first serious toolmaker. These two types lived in the same region at the same time, apparently for hundreds of thousands of years. Dr. Leakey dug up *Paranthropus* in 1959 and anthropology has been abuzz since then.

There's no argument among the experts that *Paranthropus* (see front cover for reconstruction of his head), or *Zinjanthropus* as he is sometimes called, was a vegetarian.

He had a face that would terrify a gorilla. His jaw was three times as heavy as a man's today. He stood about five feet tall with beetled brow ridges and a pushed-in profile. He walked on two feet.

For chewing his diet of berries, leaves and nuts, he had molars twice as big as modern man's and he wore them down in a hurry. However, since he usually died between the ages of 18 and 20, dental work wasn't a problem. Dr. Leakey estimates that five out of seven of these, our "cousins," died before they grew up.

Bones of this near-man have been dated at Olduvai Gorge in Africa from about 1.86 million years ago to perhaps half a million years ago. During that time, his looks changed not at all. Dr. John T. Robinson of the U. of Wisconsin says similar remains have been found in India, in South Africa and in Java. What happened to this relative of mankind is still a mystery. Perhaps a drier climate destroyed his food supply. Or, perhaps, his cousin the hunter dined on him until he became extinct.

The arguments begin here. Exactly what species led to us and

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Simon, pet Sykes monkey, cuddles around the neck of Mary Leakey during an Olduvai Gorge search.

how many manlike species were there? This brings up the subject of Dr. Leakey's latest find at Olduvai. Nobody quarrels about the age of the 1.75 million-year-old fossil, but scientists do argue about what it is.

Dr. Leakey thinks it is distinctly human. In fact, he thinks it is one of four types of early man living in Olduvai Gorge, three of them at the same time. The earliest one was an *Australopithecus*. He was followed by three types that lived side-by-side: one, *Paranthropus;* two, *Homo habilis* (man with ability); and three, *Homo erectus*. Dr. Leakey thinks the latter types, both talented, made tools and chased game a million years ago. In fact, Dr. Leakey contends that *Homo habilis* was our ancestor.

Step-by-step lineage?

Many prehistorians disagree. They think man evolved in one orderly sequence, type by type, until modern man appeared. They adhere to the classical belief that only one line of stock led to us. Proponents say that toolmaking was such a complex, important step that only one species could master it.

"I don't see how there could be more than one culture-bearing lineage at one place at any time," says the U. of Wisconsin's Dr. Robinson. "The acquisition of culture is such a powerful one that one [species] would get the upper hand, kill off any others," he sums up in favor of the orderly position.

Dr. Leakey, not mincing words, has called his opponents "fossilized." New evidence, he says, indicates that "even the textbooks must be junked."

"In anthropology, as in all sciences, you have to be objective. Where would a person be today if he clung to the ideas of 20 years ago in atomic physics or in chemistry?" he said in a recent interview with *Science Digest*.

"It was popular about 40 years ago to think that man arose from an ape, that there would be a 'missing link,' that one line of evolution would lead to man.

"It comes from a religious attitude, too, that man was a special creation.

"At Olduvai in Bed II, we have four kinds of giraffe, one very much like today's and three that were specializing away from that. Only one survived. There are six kinds

of elephants and four kinds of pigs. Why should there only be one line of man? It's a prejudice."

He also rejects the idea that toolmaking was a jumpoff point for mankind. Jane Goodall has shown that chimpanzees can use and make tools, and teach their youngsters to do so (see "Are Chimps Really Animals?" Feb. 66). Then surely, Dr. Leakey argues, early manlike primates with larger brains than chimps have, could have done as well, probably better.

Ancestry pushed back

The question of man's ancestry is a hot, unsettled one. It began in the 1700's when Archbishop Jacobus Usserus calculated the date for man's creation at 4004 B.C. That's been pushed back. Textbooks today favor an ancestry of 400,000 to 800,000 years, based on carbon-14 tests of *Homo erectus* (Java and Peking men). Much of today's uproar comes from fossils found by Dr. Leakey and his wife, Mary, in dusty Olduvai Gorge.

Olduvai Gorge is unique. Nowhere else on earth is there a site that chronicles man's early history in a known sequence. Its stratigraphy is clear, the levels are numerous and fossils abound.

A million years ago, the Olduvai climate was subtropical vegetation. "Giant pigs, elephants and rhinos lived in the area; there had to be an immense intake of vegetation," explains Dr. Leakey. A lake nestled at the feet of two volcanos.

Periodically, the now extinct volcanos Ngorongoro and Lemagrut erupted, trapping and encasing early man and animals in an ash and lava flow. These two materials can be accurately dated with potassium-argon tests. These tests measure the length of time needed for potassium 40 to decay into calcium 40 and argon 40. The tests can date samples between 100,000 years and the age of the earth with only a small margin of error.

During the next half million years, the lake was covered with 300 feet of sediments. Earthquakes then reshaped the land, created a new chasm, the Great Rift Valley. Olduvai Gorge today is a channel cut through the valley's cliffs by erosion and torrential rains. It slices through beds of the long gone lake.

The Leakeys have explored two key areas of the Gorge, Bed I and Bed II. Bed I dates back two million years and Bed II extends from about one million to one-half million years. The gap between the two is at least one-half million years. The sequence of events during that time is the key to deciding which school of thought is right.

A member of the orderly evolution school of thought, Dr. Robinson believes that *Australopithecus* evolved into *Homo erectus*, which gave rise to *Homo sapiens*. Dr. Robinson, with anthropologist Dr. Robert Broom, found evidence in South Africa that *Australopithecus* stood erect and walked on two feet. Robinson determined that they made and used stone tools. He is

Dr. John T. Robinson believes Leakey has yet to prove his theory that man had several early relatives who made and used tools.

quick to add, "There are clear indications that *Australopithecus* never developed anything but the most superficial culture." (When prehistorians talk about culture, they mean simple tools like hand axes. These are pear-shaped stones with some chips knocked off one end to improve the cutting edge of the stone.)

"There is no question in my mind that the material attributed to *Homo habilis* and *Homo erectus* in Bed II at Olduvai represents the early stage of *Homo erectus*. I think they are two successive stages of one single lineage, culminating in ourselves," states Dr. Robinson.

Dr. Leakey, whose first expedition to Olduvai was in 1931, sees another story. He thinks that *Homo habilis* led to us and was the older species. *Homo habilis* specimens at Olduvai have been dated at least 750,000 years older than the *Homo erectus* individuals. He thinks the *Homo erectus* became extinct without leaving any progeny.

The Leakeys think Bed II contains clear evidence for three cultures that existed side-by-side and for *Homo habilis* as our direct ancestor. "We must now look at the origin of man with fresh eyes. There have been too many preconceived ideas masquerading as facts," says Dr. Leakey.

Dr. Leakey, whose finds have pushed back the beginnings of man by more than a million years, suspects even more years will eventually be added to our ancestry. He bases this belief on the sophistication of the tools on the oldest level at Olduvai uncovered so far. "It must have taken at least a million years to make tools like these."

No one is more qualified than Dr. Leakey to make judgments. A persistent man, he contended from his early days at the U. of Cambridge in England that man originated in Africa. At that time, experts were certain that man began in Asia where the Java and Peking men had been found. Dr. Leakey and his wife followed their dream, inspired by Charles Darwin's belief that man began in Africa, through 28 boneless years. They found hand axes and tools galore. In fact, they found a whole culture which they named "Oldowan." But they did not find remains of tool makers.

In 1959, they found bones belonging to "Our Dear Boy" or *Paranthropus* (the vegetarian). They found many tools on the same

level, but not directly associated with their find.

Dr. Robinson proposed that *Paranthropus* did not make or use tools. He suggested *Paranthropus* did not change for a million years because he did not use tools. But Olduvai was full of pebble tools. Then, between 1961 and 1964, the Leakeys found fossils of a hunter. The puzzle was solved. He, not the vegetarian, made the tools. But what was he?

Dr. Robinson thinks he was a sophisticated *Australopithecus* and a very early version of *Homo erectus*. The U. of Wisconsin expert does not recognize *Homo habilis* as a separate species but believes it is only a variation of the central pattern.

Dr. Leakey is confident that *Homo habilis* is a separate species and an important one. *"Homo habilis,"* he said, "had the same general characteristics as man today," although the species stood only about four and a half feet tall.

"The woman would fit into a size 3 shoe," Dr. Leakey declared. Her feet, as well as her mate's, were built just like modern feet.

So far, fossil parts of seven individuals have been recovered from Olduvai. "Of *Homo habilis,*" said Dr. Leakey," we have parts of two hands, a foot, two leg bones, part of a collar bone, several jaws and parts of three skulls. One was a woman around 40 years of age with a severe case of arthritis, one was a man about 12 and two were between 18 and 20.

"The most sensational thing about *Homo habilis* is that he could do this . . ." (Dr. Leakey illustrated by rubbing his thumb and forefinger together) ". . . and could control that with his brain. The ape and chimpanzee can only grasp like this . . ." (he held a pencil between his fingers and thumb as if he had mittens on) ". . . with much less control, mostly arm movement. Both *Homo erectus* and *Homo habilis* had fine hand control combined with the brain capacity to direct it."

And what was life like for those ancestors a million years ago at Olduvai?

"By and large, they died young, around 20 [years of age]. They probably attained independence from their families at 9 or 10, with mating between 11 and 12. They were considered old at 20. That's my guess," Dr. Leakey said.

"We know that *Homo habilis* lived in one home for a considerable length of time. He was definitely a homemaker."

Dr. Leakey and his wife have uncovered several "living floors" at Olduvai. One of these contains a semicircle of stones, apparently to break the wind. "Around that stone windbreaker, we have found the bones of at least 300 animals. They were killed and eaten on the site, apparently by only one family and obviously over a long period of time. No animal besides man does that." He added that chimpanzees don't come close to forming permanent homes.

Further, Dr. Leakey has found the fossil's braincase much too large to be that of an *Australopithecus*. The range of the latter is around 480 cubic centimeters. The largest *Australopithecus* brain case ever found measured 530 cubic centimeters. On the other hand, three measureable specimens of *Homo habilis* have braincase capacities from 620 to 640 cubic centimeters. Modern man's is about 1,200-1,500 cc.

The potassium-argon dating method shows *Homo habilis* lived from two million to 750,000 years ago. That compares with a recognized span of 500,000 years for both *Homo erectus* (the earliest heretofore recognized man) and *Homo sapiens* (modern man). Olduvai Gorge's *Homo erectus* individual dates back about a million years. And, of course, *Paranthropus* was an Olduvai Gorge resident about one million years ago.

Dr. Leakey says of the three cultures that he and Mrs. Leakey have found side-by-side in Bed II: "One is the pebble-chopper and skinning flakes (flake tools are chips struck from a large core material, generally they have sharp edges and are well-suited to cutting tasks such as skining); the second one is a true hand-ax culture and the third is a combination of some hand axes, bone tools, scrapers, what appear to be woodworking tools, hollow knot scrapers and leather-working tools."

One major problem with the three cultures is that there is no way to connect a species with its own culture. Perhaps future work in Bed II will provide some of the answers.

Home erectus, which present chronology places as the first man of our own genus, was modern of limb but more primitive of hand and brain. He was extinct prior to the time of early *Homo sapiens*. There is no known direct connection between the two.

Homo erectus individuals from Asia were found in Java in 1891 and in Peking in 1927. It is 8,000 miles from Olduvai to Java or to Peking.

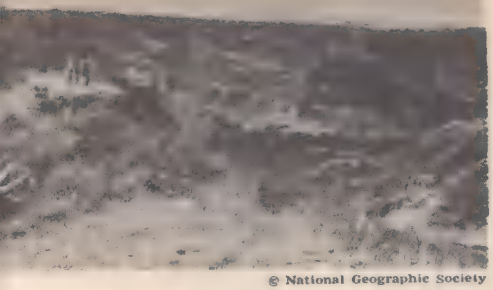
In 1961, site work began in the Ambrona Valley in Spain. It appears that fires were deliberately set to drive mammoth elephants into a bog where they were dispatched for food. The complex of bones, dated at 300,000 years ago, was mixed with hundreds of manmade tools.

But not a single bone of any *Homo erectus* or any other man-like creature is there. However, the widely scattered fires suggest that they were set on purpose and controlled. If correct, that would push back the date of controlled fire.

Another cultural sophistication, tools, are now being traced and dated more accurately than ever before possible.

Oldowan choppers were carried out of Africa through the Middle East and into Europe and probably Asia. No one knows whose path is strewn with these choppers. Fossils of *Australopithecus* have never been found outside of Africa.

So-called Acheulian tools, characteristically pear-shaped and held in the palm, are attributed to the period of time 75,000 to 150,000



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Visitors can see how erosion sliced through Olduvai Gorge to expose layers of man's past.

years ago. But in 1963, Eric Higgs of the U. of Cambridge returned from northern Greece with a slew of hand axes, very early Acheulian hand axes and the chippings of Neanderthal men. (The stooped, beetle-browed Neanderthal men are practically infants on the family tree, living in Europe between 110,000 and 35,000 years ago. They are the first true *Homo sapiens.)*

Dr. Higgs is convinced that man's first migration to Europe from east and central Africa took place about 250,000 years ago.

Prof. Chester Chard of the U. of Wisconsin decided to trace man's path as he fanned out of Africa to colonize the world. Dr. Chard compiled data of all known axe sites, their geographic position and condition. Axes are commonplace at hundreds of sites from the Thames River in England to Table Bay in South Africa. Their age can be approximated from their patterns and executions. Dr. Chard decided there were four prehistoric migration routes to Europe.

But what about prehistoric man in America? Well, five years ago, evidence was available showing only that man had been in America for 5,000 years. However, that has now been pushed back to 18,000 years.

"That is just impossible," says Dr. Leakey. "I can guarantee 60,000 to 80,000 years in this country. It is inconceivable that man, the most curious and mobile of all animals, would not have come to America when the elephants, the tapirs and deer came from Asia. All of these animals move in herds, man was much more sparse, hence more difficult to trace." Dr. Leakey says that no evidence does not mean that man did not come. "Man spread out from Africa to Asia, to Europe. It is inconceivable that he would stay out of America, saying, 'No I can't go there yet. It's not time for me.'

"If people look in places where conditions were good for him, near water and where animals were, he can be found. He will be found. They just haven't looked yet in the right places.

"The point projectile cultures are at least 15,000 years old. (These cultures made similar pointed stone implements.) They had to start from something. What we need is a break from conservatism. At least people should go look for remains of man before they say he wasn't in America. I believe he was here," says Dr. Leakey.

Other cultural finds around the

world have built a convincing framework for a longer human history.

In the U.S.S.R., archaeologists report they have found homes built about 40,000 years ago in Soviet Central Asia. The homes are described as dugouts and semi-dugouts made from the karagach tree. Apparently they were winter homes. Summer homes were built of reed. Traces of rush stacks were found near the dugouts.

Alexander Marshack, a science writer and amateur archaeologist, reports in *Science* that the systematic scratches found on 2,000 man-made objects dating back 35,000 years are lunar cycle records.

Lunar cycle pattern

Marshack compared a fragment of 35,000-year-old reindeer bone found in Czechoslovakia, mammoth ivory from the Ukraine a few thousand years later and painted notations from rock walls in Spain about 2,000 years after the retreat of the last Ice Age. In all cases, there is a striking parallel between the pattern and the lunar cycle.

To the unaided observer, full moon and new moon vary because of cloud and fog. Sometimes a month will appear to be 30 or 31 days. If man kept records as far back as the last Ice Age, long before the birth of agriculture, then the conventional view that the calendar was a by-product of farming is wrong.

Settlements have long been viewed as a by-product of planting crops. Thus, Maurits van Loon's discovery last year of 17 superimposed occupation levels at Tell Mureybat, a village mound besides the Euphrates River some 200 miles northeast of Damascus, Syria, was a surprise. The U. of Chicago team dug up 10 centuries of village artifacts. Analysis of plant and animal remains show nothing but wild foods. Meat is from wild cattle, ass and gazelle, fallow deer, boar, hare and wolf. Vegetables identified include over-roasted and ground wild barley, wheat and lentil.

Mathematically, ancient man may have been quite sophisticated.

Dr. Alexander Thom, professor emeritus of engineering science at the U. of Oxford, studied hundreds of ancient stone temples. He found that 4,000 years ago, builders used an accurate unit of length equalling 2.72 feet.

At least three temples are based "on exact Pythagorean triangles and the others fail by such a small amount that the discrepancy would hardly be apparent on the ground." If the ancient Britons did not actually use Pythagoras's theorem, their geometrical and mathematical systems were only slightly less revolutionary than the discoveries of Pythagoras or Euclid some 1,500 years later, he says.

Already, in just a few years, the findings of anthropologists like Dr. Leakey and others have startingly lengthened the shadows of man's ancestry. As Mary Leakey says, "The situation is very much more complex than we had dreamed."

What science is learning about smell

Smell is one of man's neglected senses. But recent research has stimulated renewed interest. Some day, odors may be used to help the sick.

by Andrew Hamilton

We often joke about the sense of smell—scientifically known as olfaction—because we pay so little attention to it. But in primitive societies smell was a matter of life or death: to scent a quarry, to test the edibility of food, to tell friend from foe. Modern man seldom uses the sense of smell except to detect a burning roast in the oven, or to enjoy a rose bush.

Long one of our neglected senses, smell is still something of a scientific mystery. Science knows much more about the senses of sight, hearing and touch. In the past few years, however, as Dr. Herbert Stone of the Stanford Research Institute points out, the sense of smell "is belatedly experiencing increasing attention in the laboratory." Here's why:

1. Scientists are curious about the physics and chemistry of olfaction.

2. Doctors are interested in determining its role in health and medical treatment.

3. Businessmen see its commercial possibilities.

The olfactory region is located at the top and at the back of the nasal passage—deep within the skull. When air is breathed through the nose, it is warmed and filtered while

eddying past three layers of bone known as the conchea. In a *cul-de-sac* at the top of the nasal passage are two yellowish patches of olfactory tissue—each as large as a fingernail and covered with a moist mucous.

Imbedded in the mucous are thousands of tiny hairs called cilia. When stimulated by odors, the cilia transmit electrical messages to the olfactory bulb located directly above—and from there into a primitive part of the brain. The research of Dr. Robert C. Gesteland and Jerome Y. Lettvin at M.I.T. has demonstrated this mechanism.

2,000 year-old theory

Scientists can describe the physics of the olfactory system better than its chemistry—even though the chemical theory dates back to the ancient Roman poet Lucretius. He speculated that the human "palate" contained minute pores of varying sizes and shapes. Every odor-producing material gave off "molecules" of a particular size and shape. When the molecules fitted into the pores, the odor could be recognized.

Modern chemists say that Lucretius' 2,000-year-old speculation on the geometry of smell was essentially correct. In 1949, Dr. R. W. Moncrieff of Scotland suggested that the olfactory system is composed of receptor cells (perhaps as many as 20 to 40 million) in the cilia or at the base of the cilia. Odorous molecules fit into these receptors like a key into a lock.

Further substantiation came from Dr. John Amoore, then of Oxford University and now of the USDA's Western Regional Research Laboratory in California. After testing 600 organic compounds, he identified seven primary odors and described the shapes of their receptors:

1. Camphoraceous (moth repellant), 2. Musky (Angelica root oil), 3. Floral (roses), 4. Pepperminty (mint candy), 5. Ethereal (dry cleaning fluid), 6. Pungent (vinegar), 7. Putrid (bad egg).

Other scientists have reduced the primary odors to four: 1. Fragrant, 2. Acid, 3. Rancid, 4. Burnt.

Most odors are blends of varying degrees. They can be blended just as the primary colors of red, blue and yellow can be mixed to produce thousands of subtle shades. Industrial chemists have identified some 30,000 different smells. Some cancel each other out: gardenia and orange blossoms for example.

Olfactory characteristics

While smell is not the most highly developed sense in man, it is very sensitive. The organs of the body react to some smells when there is only one part per million of air. Artificial musk can be smelled when there are only .00004 milligrams per liter of air. The olfactory system tires easily and grows insensitive to a particular smell after three to five minutes. But it is sensitive to each new smell.

If you have a cold, an apple and a potato can taste the same

One of the striking properties of the sense of smell is the change in quality that occurs with changes in concentration. At high levels the odor of musk is extremely unpleasant—yet in low concentrations it is used as a base for many perfumes. At low levels butyric acid, a component of butter, is pleasant. But in even moderate concentrations it can cause nausea.

We probably use our sense of smell more than we realize. What we consider to be our sense of taste is, in most cases, our sense of smell. For example, when we eat a thick, juicy steak smothered with mushrooms, our enjoyment comes primarily through the olfactory organs rather than the tongue's taste buds, which distinguish only salt, sweet, sour and bitter.

Think back to the last time you had a cold. You couldn't "taste" anything for the simple reason you couldn't smell it. A clogged nose blocked the olfactory system and crippled your sense of smell. This can be demonstrated. Cut up small cubes of apple and potato then close your eyes, hold your nose and eat them. You cannot tell the difference.

While much of what we think of as taste is really smell, another sense usually considered to be smell is not. This is the sensation from a sharp whiff of ammonia or chlorine —the so-called "chemical sense." This sensation is widespread among animals although the location of its receptors varies. In fish and frogs, it is sensed by the skin; in man, by the nose and the under side of the eye lid. You don't "smell" smog. You recognize it by means of your chemical sense.

Among doctors there is a growing belief that the sense of smell may be related in some subtle way to your health. If the sense of smell is sharp and in good working order, a person is healthy; if there is loss of a sense of smell, it may indicate a hidden disorder.

It is well known that a complete or partial loss of the sense of smell means reduced appetite. And in some medical situations this can complicate treatment. It has been suggested that hospitals should experiment with "odor therapy" by blowing pleasant scents into each ward to promote the patient's feeling of security and well being. For example, the scent of honeysuckle and hot buttered biscuits might be prescribed for a Southerner.

Apparently there are considerable differences in sensitivity to smells. One of these differences is between young and old. Young people, for example, usually do not like the aroma of a certain coffee substitute. But to people 50 and over, it is very pleasing.

Another human reaction is the ability to adapt to strong and un-

pleasant smells. Workers in glue factories, fish canneries and meat packing houses seem to be able to work and even enjoy their lunch in a stench that would drive most visitors out of the place in a hurry. Germans who learn to like limburger cheese and Chinese who find pleasure in ancient eggs exhibit the results of training rather than any natural fondness for such odors.

Scientists have suggested that minute quantities of odorants could be used to attract insect pests. They could then be sterilized by radiation and released. Thus, in a few generations, the insect population could be wiped out or reduced to manageable size—without the use of harmful insecticides.

In spite of the fact that scientists still know very little about smell, business and industry have been quick to take advantage of what knowledge is available. As a result, putting aromas into or taking them out of products is a $25,000,000 business in the United States today.

Here are some examples:

- A supermarket wafts the synthetic odor of strawberries throughout its store—leading patrons to the frozen food section where there is a special sale on frozen strawberries.
- Plastic Christmas trees are impregnated with an odor more "piney" than that of natural trees from Oregon.
- The "new car smell" is a blend of banana oil, glue, leather, rubber, gasoline and plastic scents. To entice business, some used car dealers soak a piece of flannel in a synthetic liquid containing these scents and place it behind the back seat.
- At 1964-65 New York World's Fair, the Indian Village had a manufactured scent—curry and cows.
- The Chicago White Sox organization has been searching (unsuccessfully so far) for the scent of hot buttered popcorn to spray in its stadium. It's said to be a smell "that makes people feel good."
- Electric blankets are scented with lavender, lighter fluid is perfumed with jasmine, nylon ropes are made to smell like tarred hemp, mousetraps are impregnated with a cheddar cheese smell.

"I foresee the day," said Robert Swaine of the Arthur D. Little Company, industrial consultants, "when non-aroma will be non-acceptable. Homes, offices, planes, trains and boats will have a pleasant, positive aroma."

Scientists, medical researchers and businessmen are revising the notion that the sense of smell is a minor one. But there are still many unknowns. Does the nose adapt alike to all odors? What are the effects of mixing odors? How rapidly does the nose recover its sensitivity to an odor after it has become adapted to it?

And finally, a last word from Dr. Stone of the Stanford Research Institute:

"Extensive study will be necessary before the true function of olfaction can be determined or before industrial development depending upon it can be undertaken on a rational basis."

Number freeze

THE disembodied rubber-gloved hands above (actually attached to a technician) are bravely test-dialing the new Touch-Tone telephone in a minus-60-degree temperature to see how long it will take before the phone freezes.

The environment test is one of several laps along the Performance and Reliability Lab gauntlet run by all new model phones before becoming standard telephone equipment. The purpose is to determine how well an instrument will function in varied weather conditions.

The experts who do the testing are Western Electric engineers. Their laboratory is in the company's Indianapolis Works.

Three engineers and two associates juggle the odd array of testing equipment in the two air-conditioned, humidity-controlled rooms of the P & R lab.

Compressing years into minutes in order to see how telephones will hold up over their average 20-year life span is another important part of the carefully contrived series of tests.

One test mechanism, a guillotine sort of contraption, repeatedly drops the telephone, duplicating stress on a phone accidentally dropped from a table.

Another telephone torture test is performed by "Gary's Wheelbarrow." This is an apparatus that dials the phone for what would amount to 160 years of average use. At that point, to nobody's surprise, the instrument finally gives out.

Grippi & Waddell Gallery

Type your name and play your personal tune on this typewriter hooked up to piano keys. The keys strike rods of graduated lengths, and the tones come out of the cones.

Science invades art

WHETHER art came out ahead or not is arguable, but two recent invasions by science shown on these pages have certainly not left it the same.

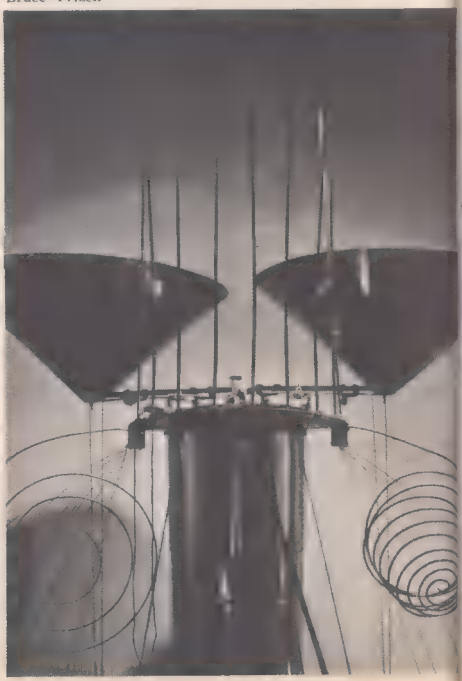
On this page are two of the musical instruments created jointly by an acoustical engineer, Bernard Baschet, and his brother, Francois, a sculptor. Most are played by setting tuned lengths of metal into vibration and channeling the vibrations into the air through paper or metal cones.

Invited to "please touch," visitors to the Baschets' New York gallery attacked with hammers and bows and by rubbing wet fingers along glass rods. Out came resemblances to tubas, marimbas, cellos and bells.

Although an experimental orchestra in Paris plays the instruments, the Baschets consider them primarily sculptures. Serious modern musicians agree.

Bow or hammer vibrates metal rods over a resonator as decorative spirals hum.

Bruce Frisch



Galeria Bonino

In this example of a new art form, an electric coil distorts a television picture into a pattern with the title, "(log$_a$ Cage — McLuhann$^{1/3.5}$)/Norbert Wiener = ± sorry."

All shows look good on the television sets doctored by Nam June Paik. At least they are usually unrecognizable.

Movement of the normal images makes the abstract patterns shift and flow. By playing the special attachments, a second program of movements can be superimposed.

Some of the dozen or so sets Paik exhibits are accompanied by pseudo equations like $\int^{me}$ t=you (cybernated art) dt — art for cybernated life/dx = $|3/\infty|$," or quotes like, " 'Electronics' has been the catchphrase since 1950, in science and society, in music and stock-market . . . why not in art?"

Other electronic pursuits of Paik, a Korean educated in Japan and Germany, are assembling electronic music for Radio Cologne, Germany, and building a robot that excretes dry beans.

Superposition, inversion and high contrast, illustrated here, are some other techniques of Paik's for manipulating TV. He uses a videotape recorder for experimentation.

Galeria Bonino

QUIZ

KFS

The best known fungus is the commercially-grown mushroom.

It's a moldy world

by John and Molly Daugherty

FUNGI exist everywhere. They find food in almost anything and live in every climate. They are indifferent to light and dark and are amazingly adaptable.

Although one kind is so particular it lives only on the left hind leg of a water beetle, no part of your body is immune to *some* kind of fungi, given the opportunity to invade it.

What do you know about this low life of the plant kingdom?

1. Fungi that have tiny threadlike hyphae mass into the mycelium. A fungus colony can grow half a mile of mycelium in as short a time as
   a. A week
   b. An hour
   c. Twenty-four hours
2. The fiber most susceptible to mold infestation is
   a. Cotton
   b. Nylon
   c. Silk
3. If life exists on Mars, scientists believe we shall find that it has evolved either to or through a stage of single-celled organisms like our bacteria or fungi. If Mars has fungi, they would
   a. Grow in media satisfactory to earth fungi
   b. Not grow at all in earth media
   c. Not be expected to grow in media satisfactory to earth fungi
4. The mold that is used in making Roquefort and other blue cheeses is
   a. *Mucor*
   b. *Pencillium*
   c. *Aspergillus*
5. Chlorophyll exists in
   a. No fungi
   b. All fungi
   c. Only parasitic fungi
6. Of the approximately 250,000 species of fungi, scientists have identified about
   a. 225,000
   b. 100,000
   c. 50,000
7. Among paints and varnishes, the type most susceptible to fungi is
   a. Spar varnish
   b. Shellac
   c. Water-based paint
8. Loaves of bread preserved in sealed pyramids in 3,000 B.C. have been found in Egypt. The use of yeast in making bread is very old. Originally, yeast fungi in the air must have settled on the warm dough causing it to rise. Later some of the risen dough was saved as a starter for the next batch. The yeast feeding on the dough released
   a. Carbon dioxide
   b. Oxygen
   c. Hydrogen

9. **Diseases caused by fungi attack millions of people. Athlete's foot is common. An estimated 30,000,000 Americans have had some form of histoplasmosis, and 500,000 more will get it this year, according to statistics. Histoplasmosis is**
   a. **An intestinal disease**
   b. **A respiratory disease**
   c. **A disease of the bloodstream**
10. **The yeast used in wine-making grows and reproduces by budding. A daughter bud breaks away from the mother cell, and the process is repeated a dozen times before the mother cell dies and in turn becomes food for further growth. The converting of the grape sugars to alcohol increases the alcohol percentage until it acts as a limiting factor in further action and growth of other microorganisms, too. The microorganisms that will not grow in wine are**
   a. **Acetic acid bacteria**
   b. **Lactic acid bacteria**
   c. **Molds**

Answers:

1—c Twenty-four hours. You've probably noticed that bread molds quickly. Calcium propionate or some such ingredient is often added to bought bread to retard spoilage.

A large fungus needs time and material for the hyphae to fructify.

Heavy rain after drought induces fructification. Toadstools and mushrooms pop up after rains at the end of a dry summer.

2—a Cotton—as every woman knows who has ever let her dampened-down clothes go for a while before doing the ironing.

Captains of clipper ships were wary of cargoes of raw cotton because of the risk. When the cotton got damp from moist sea air, fungi grew inside the bale. As heat evolved inside the bale, spontaneous combustion often occurred.

Nylon and most other man-made fibers are not affected by fungi. Sometimes, however, the finished fabrics are susceptible to fungus growths because of other organic materials introduced.

Natural silk usually resists fungus growths.

3—c Not be expected to grow in media satisfactory to earth fungi. Although fungi may look alike and have the same chemical composition, they don't grow interchangeably in one another's environment. A great variety of media would have to be used in any experiment to grow Martian fungi successfully, but the results would be more valuable than those of a chemical analysis.

4—b *Pencillium.* This common mold is related to the mold used in making penicillin but has no antibiotic properties. In France about 600,000 ewes supply the milk for making true Roquefort cheese in many caves in the mountainsides. To prepare the mold, a culture of *Penicillium* is put on a loaf of fresh bread and allowed to stand for four or more weeks. The mold growth is gathered, dried, and powdered. This is sprinkled on the cheese, and some is injected with a needle.

The mold is allowed to grow in the cheese stored in the caves for two to five months.

Mucor is bread mold, and *Aspergillus* is a mold obtained from an acid used to make photographic developer and black ink.

5—a No fungi. Fungi are filamentous plants that are not photosynthe-

tic. Fungi feeding on living plants and animals are parasitic; on dead or decaying plants or animals, saprophytic. Parasitic fungi are usually harmful.

6—b About 100,000 have been identified by mycologists. Although the physiology of all fungi is similar, there is a great variation in size. A mushroom 50 feet around and weighing 105 pounds was found in France, yet one tablespoon can hold 900,000,000 fungi or 15 sextillion spores released by just one fungus.

7—c Water-based paint. Oil-based paints are also susceptible to fungi. The addition of fungicides to paint inhibits fungus growth. In water-based paints the fungicide must be water-soluble and become part of the emulsion. Applied paints both indoors and out may be discolored by fungi. The fungi may consume the paint itself or cooking grease on the paint. Fungi attack paint especially in hot humid climates. They may contaminate water-based paint, causing separation of the emulsion and water while still in the can.

8—a Carbon dioxide. As the yeast grows, carbon dioxide is released and bubbles through the dough causing the bread to rise. Among early settlers in America, mothers always gave their daughters yeast starters for making bread when they got married. Yeast starters were handed down many generations. The sourdough bread of the West carried out the same idea.

9—b A respiratory disease. The fungus *Histoplasma capsulatum* causes histoplasmosis. The fungus grows in the soil, especially in humid regions. A similar disease, coccidioidomycosis, occurs in dry regions.

Skin tests reveal whether you have had either disease. Often the victim is unaware that he is ill. Symptoms include a cough, a cold or an allergy, and a fever. Attacks are usually mild, but a few deaths have occurred. Ten Boy Scouts in a troop of 113 in Missouri had chills, coughs, and fever, and all 113 were given a histoplasmin skin test, to which 97 percent reacted positively. They had breathed the fungus while raking leaves in a park. In Iowa 30 cases of histoplasmosis developed near a construction site.

10—c Molds. Molds are no problem in wine because they don't grow in wine after fermentation. Mold may grow on an unclean cork or container, however.

Some microorganisms grow in wine. Several species of *Actobacter* —bacteria which produce acetic acid —grow in wine. Sulfur dioxide is used to inhibit them. Because these bacteria are aerobic (needing oxygen), bottles and casks are kept full to prevent the wine's turning to vinegar. Lactic-acid-forming bacteria of several species which are anerobic (not needing oxygen) must be inhibited, too.

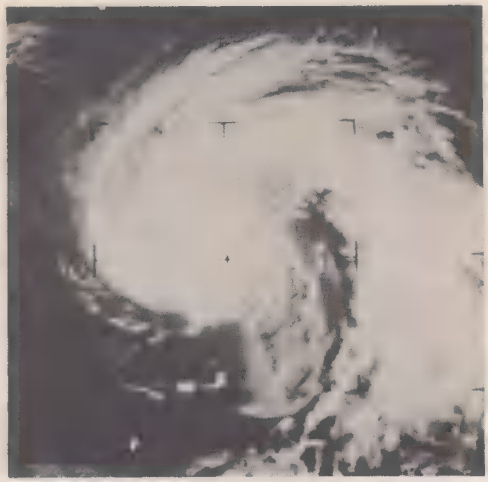
Score yourself:

9—10—You're high on mycology.

4— 8—You probably know your mushrooms!

0— 3—Maybe you're a mycophagist and don't know it!

PLEASE EXPLAIN



The swirling clouds of a tropical storm as seen by one of our weather satellites dramatically illustrate the dynamic action of the atmosphere.

How was the earth's atmosphere formed?

Where did the air we breathe come from?

The planets originated, astronomers suspect, out of swirls of gas and dust made up, in general, of the various elements present in their usual cosmic abundance. About 90 percent of the atoms were hydrogen and another 9 percent were helium. The rest included all the other elements, mainly neon, oxygen, carbon, nitrogen, silicon, magnesium, iron and aluminum.

The solid globe of the earth itself formed out of a rocky mixture of magnesium, iron and aluminum silicates, with molecules that clung tightly together through chemical forces. Excess iron slowly sank through the rock to form a hot, metallic core.

The solid matter of the earth, as it collected, trapped some gaseous material and retained it in spaces between solid particles or through loose chemical union. These gases would include atoms of helium and neon, which remained uncombined; and atoms of hydrogen, which either combined in pairs among them-

selves to form hydrogen molecules (H_2), or combined with other atoms. They could combine with oxygen to form water (H_2O), with nitrogen to form ammonia (NH_3) or with carbon to form methane (CH_4.)

As the material of the forming earth packed down, gases fizzed out through the squeezing effect of pressure and the more violent effect of volcanic action. Molecules of hydrogen, as well as atoms of helium and neon are too light to retain and they escaped rapidly. Earth's atmosphere came to be made up of what remained: water vapor, ammonia and methane. Most, but not all, of the water vapor condensed to form an ocean.

This is still the sort of atmosphere possessed by planets such as Jupiter and Saturn which, however, are large enough to retain hydrogen, helium and neon.

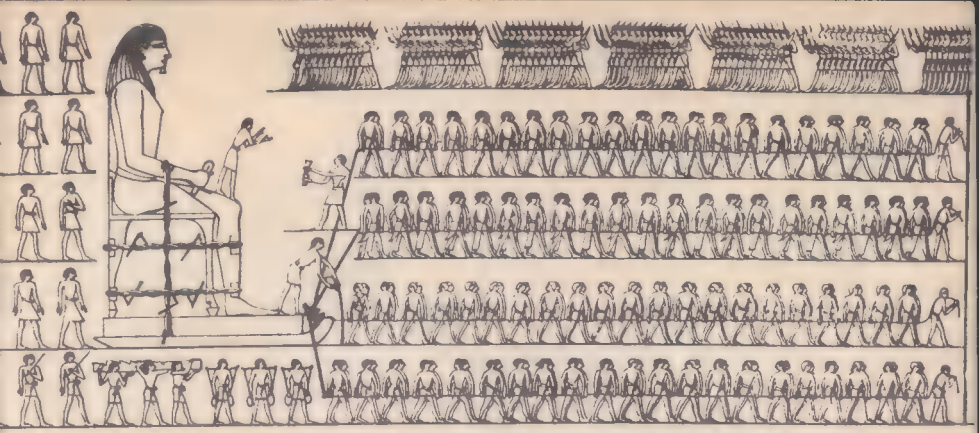
The atmosphere of the inner planets, however, began to evolve chemically. The ultraviolet rays from the nearby sun broke up molecules of water vapor to hydrogen and oxygen. The hydrogen escaped, but the oxygen accumulated and combined with ammonia and methane. With ammonia, the oxygen combined to form nitrogen and water; with methane, to form carbon dioxide and water. Gradually, the atmosphere of the inner planets changed from ammonia plus methane to nitrogen plus carbon dioxide. Mars and Venus have nitrogen plus carbon dioxide atmospheres today and the earth must have had such an atmosphere at the time life first formed billions of years ago.

Moreover such an atmosphere is stable. Once it is formed, additional ultraviolet action on water vapor allows free oxygen (with molecules made up of two oxygen atoms, O_2) to accumulate. Further ultraviolet action alters such oxygen to ozone (with three oxygen atoms to the molecule, O_3). Ozone absorbs ultraviolet and cuts it off. Little ultraviolet can penetrate the ozone layer in the upper atmosphere to break up water molecules below and the chemical evolution of the atmosphere stops—until such time as something new is added.

On earth, something new *was* added. A group of life-forms happened to develop that could use *visible* light to break up water molecules. Visible light was not stopped by the ozone layer and the process ("photosynthesis") could go on indefinitely. Through photosynthesis, carbon dioxide was consumed and oxygen was released. Beginning about half a billion years ago, then, the atmosphere was converted to the nitrogen plus oxygen one we have today. — *Isaac Asimov*

How were ancient people able to move the gigantic stones they used in building monuments? And why did they expend so much effort?

Today engineers can move weights of hundreds of tons without any particular difficulty, but ancient peoples also moved huge stones weighing scores or even hundreds of



A 12th Dynasty Egyptian tomb painting shows workmen dragging the 60-ton alabaster statue of a noble named Djehutihetep on sledge. Figure on front of sledge may be pouring some sort of lubricating material beneath runners. Some believe this illustrates the beginnings of modern technique of using lubricated machine-surfaces for heavy moving.

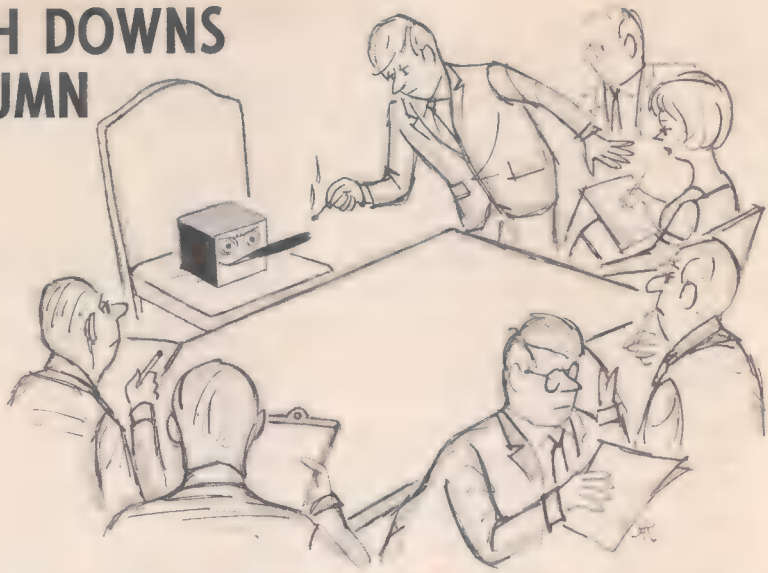
tons, and did it without the aid of steam, internal combustion engines, pulleys and often without knowing about the wheel.

A recent review of "Ancient Heavy Transport" by Robert F. Heizer, U. of California anthropologist and archaeologist, in *Science* notes that great weights were moved "by such simple friction-reducing devices as sledges, gliders or rollers, and equally uncomplicated lifting or raising devices such as inclined ramps and levers." The secret, if it can be called that, was the expenditure of enormous amounts of time and human energy. Curiously, it was men rather than animals that usually supplied the power for these colossal moving feats. Heizer explains that although a horse is 15 times as powerful as a man, ancient harnessing methods, which tended to choke the animal, reduced the horse's effectiveness to the point where it could pull only about four times as much as a man. Since a horse will eat at least four times as much as man and there were more men than horses, man become the most common beast of burden.

Many peoples, provided they had reached a certain cultural or economic level, seemed to be obsessed with building gigantic monuments. There are of course the pyramids of Egypt and the later gigantic obelisks, and the 1000-ton Colossi of Memnon. At Mycenae in Greece, stones weighing 120 tons were used as doorway lintels in tombs. In France, Spain and the British Isles there are the huge megalithic monuments, the best known of which is Stonehenge. In the New World are the colossal sculptures, stelae and "altars" of the Olmecs, Mayas and Aztecs. But by far the most impressive evidence of heavy transport in early America are the fortresses built by the Inca. Here are walls constructed of closely fitting limestone blocks weighing 200 tons.

Heizer believes that many civilizations wanted to demonstrate power and leave a record for the future. One way to do this was to construct gigantic monuments.

THE HUGH DOWNS COLUMN



The peril of the 'librain'

The library of the future may be able to store all the world's knowledge in a box compact as a brain. We're well on the way there already.

by Hugh Downs

WHEN a man first sought to communicate something to another man who was not within range of hearing or vision, he had to arrange a set of circumstances that would be (1) attention getting, (2) reasonably lasting and (3) distinguishable from random conditions surrounding it.

For example: If he wished to mark a trail, a rock cairn would have been a meaningful marker, since Nature does not make neat piles of the same size rocks, nor do animals; the rocks would stay put for quite a while and one would have no difficulty spotting a marker of this sort within a short distance.

More information can be put into a broken sapling. American Indians used this as a trail signal, placing the broken part of the young tree as a pointer to the next sign.

As man continued to expand the concept of communicating *in absentia,* meaningful arrangements of stones, twigs, rocks and logs were set up in places for the entire com-

munity or tribe to take heed, to worship or to learn. Altering the bits of material in significant ways led to the carving of stone idols and wood totem posts detailing legends; next, to picture forms that told stories; then, to the stylized pictogram and the heiroglyphic and, eventually, to the abstract sound-symbol which, linked to the spoken word, allowed a storage of sounds that reconstructed the language of the people. Thus was born the alphabet and writing.

Carved in stone, impressed in clay (and baked for permanence), man's early documents preserved his thoughts and activities, his beliefs and records, his hopes and knowledge. But a stele was hardly portable and small stone or clay tablets could not convey much. And until lighter materials such as parchment could be inked and rolled up, the ultimate repository of knowledge —the library—hardly existed.

Even then, a library was accessible only to a privileged few—at first, because of the potent magic of words transferred from one person to another without the sound of any voice. Only the priestly class could be allowed the use of such magic. Later the rich had access, and finally the idea evolved that every man has not only the right to the world's learning but also the duty to absorb a certain amount of it in order to be enlightened enough for citizenship.

At each step, the concept of proliferating stored knowledge and communication technique almost goes hand in hand with new means of doing so. Paper, ink, movable type, fast printing, zerography, microfilm, magnetic storage of information, etc., now fit in with our ideas of enlightenment.

Few voices are raised in warning any more. Henry VIII's horror at having the Bible translated into the language of common people is a thing of the past. (Robert Graves, a poet, has said that to recover our sanity we should abolish paper and deny writing materials to everyone except poets, but his is a rare attitude.) The question is, not so much whether we should continue to gather knowledge and disseminate it widely and quickly, as whether and in what ways new characteristics of the library of the future will carry man farther toward goals he sets.

What is called the microbook revolution is well under way at this moment. Newspapers, documents, business records, reports, dissertations, doctoral theses and dossiers as well as conventional books are already preserved in reductions 40 to 60 times the area of a page.

Microcards reduce the area used 500 to 1,000 times, and a whole book can be printed on a library-size file-card. Approaching the optical limit, the microdot system, already in use in espionage work, can reduce and preserve the contents of a printed page to one-millionth its original area!

This is one thing the future holds to make the library more compact. But even the optical limit is not the

A thousand books could be stored in an area the size of a pinhead.

ultimate limit in compactness. It may be the limit for printing, but not for information storing. R. P. Feynman, a physicist at the California Institute of Technology, pointed out in 1960 that since organic life can store genetic information at molecular levels in long chains of atoms in the chromosomes, coded to carry meanings of great complexity, we may one day be able to do this with all human information. Thus, it would be possible to pass the optical limit and store the contents of books, at first perhaps with actual printing down at the level of powerful electron microscopes. John R. Platt says in *The Step to Man* (John Wiley & Sons, 1966) that an area the size of the head of a pin, "which for years has been the cliché of comparison for all such discussions," could store 1,000 books of 500 pages each.

Even these possibilities are not as interesting as two others: First, the world's knowledge in all its complexity can be reduced to a few million pictures and drawings, and a few thousand different words in a given language, and to 26 letters in a given alphabet.

But all knowledge can be reduced from combinations of 26 symbols to two or even one, provided the one has an alternative, or "not-one," signal capability. The neuron in the brain fires or does not fire. The binary computer uses a "yes" and "no" signal system for everything it does (or rather a "yes" and "not-yes"—a "one" and "zero" system).

Now, suppose the library of the future can compress all the world's knowledge into a box that can be placed on a desk (which is possible if that knowledge is coded on a molecular level). And suppose input and retrieval speed is refined to approach that of electronic circuitry. We will then find that the box remarkably resembles a skull, in that it: houses stored data in a 'brain' of sorts; takes in data through channels analagous to sensory inputs; and puts out data when called upon.

The library of the future, able to sort and store and retrieve without wading through unnecessary material will, in a sense, "think."

It would take on human characteristics only if programmed to do so. The library would not have to have emotional blocks for preservation of its "sanity," since it is doubtful it could be said to have emotions. Cultural imprinting, would be unnecessary in a library.

But if this "librain" were ever called on to take over policy-making, or to empathize with human loneliness or inadequacy, or to protect areas of desired secrecy, or to do any one of a number of things reflecting humanity's tendency to abdicate its responsibilities, a real Frankenstein monster could emerge.

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Want to know about UFO's? Don't miss the next issue of Science Digest, on sale Nov. 29.

LETTERS TO SCIENCE DIGEST

Nader's 'misconceptions'

Because you saw fit to print the misconceptions and partial truths of Ralph Nader ("The 7 Safety Features Cars Need Most," Aug. '66), whose knowledge of automobiles is limited to changing a flat tire, why not show some scientific lack of bias, and solicit an article from a professional automotive journalist? I believe you will discover—because of his many years of experience and lack of political aspirations—his criticisms are quite different.

TOM MAYLONE
Troy, Michigan

Planning, not luck

Regarding your article "Surveyor—An Embarrassing Success," (Aug. '66), every article that has appeared since the successful landing of our Surveyor 1 on the moon has carried with it the complete astonishment of the scientists at Jet Propulsion Laboratory and others in the scientific world. Many scientists have made statements on our "luck" at having achieved a success on our first soft landing. I find it a little annoying that so many of our most intelligent men continually make "excuses" for our success.

My husband was a member of the Hughes Surveyor test team, and only the perseverance and long hours

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spent in testing, anticipating problems which might occur and retesting by all those concerned brought about the success of our first lunar soft landing.

The success or failure of a project does not depend on the success or failure of previous projects such as the Ranger program, but on the vehicle itself and the human element. The Hughes Surveyor team never had any doubt that the Surveyor would be successful, if it were ever launched. The only doubt they had was that the booster would fail.

May I say in closing that I enjoy your magazine and usually find it very informative.

MRS. RUSSELL G. MILLER
Inglewood, Calif.

P.S. In regard to the quote [from Dr. Eugene Shoemaker] in the first paragraph of the story, "If Surveyor had sat down [on a very rugged sector a few hundred yards away] it wouldn't have made it. . . . " Surveyor was designed and tested many times by drop tests to land at angles of 15° or less. A 15° slope is a very steep slope and revokes the opening paragraph. I find it very unfortunate that the most vocal pessimists of the Surveyor program were the least informed and the most frequently quoted with regard to the capabilities of the Surveyor spacecraft. We at Hughes knew its capacity to perform and had complete confidence in its success.

RUSSELL G. MILLER

Extraterrestrial life and the Bible

The article "The Search for Extraterrestrial Life" (Aug. '66) mentions the possibility of "life of a kind unknown on earth" somewhere in the universe. The question is asked, "Is it possible that no other place has life?" According to Dr. Harlow Shapley, "the chances are a million and more to one against man's development elsewhere exactly as on earth." In this article, Dr. John C. Lilly is quoted as saying, "If we encounter extraterrestrial species, we may encounter systems of thinking that we can't cope with."

It is interesting to note that, in every book of the Bible, extraterrestrial life (angels and God) is mentioned. This in no way seems to contradict the honest search of science. We have evidence of different forms of life—plant, animal and man—why not extraterrestrial beings and a higher form of life, God, the designing or controlling power?

HENRY LISTIAK
Phoenix, Ariz.

Amateur astronomer

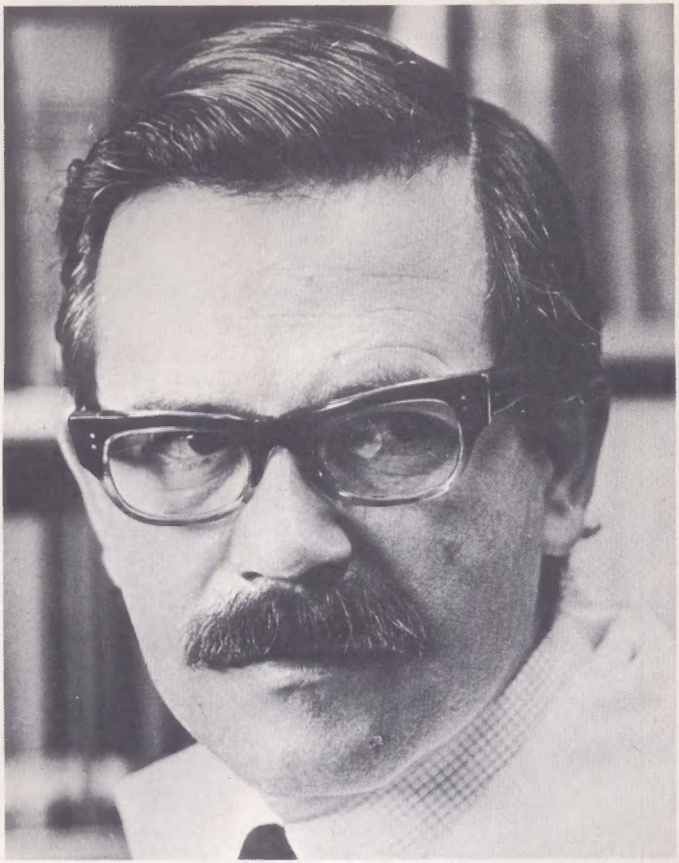
I think that *Science Digest* is a great periodical. It is written in a layman's language and it covers many fields of science. I am an amateur astronomer and find that the feature The Astronomy Story keeps up with the latest facts and theories.

LESLIE R. HUNT
Haledon, N.J.

Best advice

Referring to the article "How to Stay Off Cigarettes" (April '66—) about the best advice is, "Never get started."

ELMER J. BRASWELL, JR.
Atlanta, Ga.



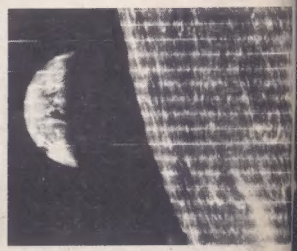
Pictorial Parade

Worm eater

CAN man eat the worm before the worm devours man and his food? This is no morbid whimsy, according to Dr. W. G. Inglis, a Scottish worm researcher (above) who gobbled down a parasitic worm from a pig to find out what happens when a man has a strange worm in his stomach. The parasite died. When a worm from a man was given a pig, instead of the worm's gnawing the porker's insides, the pig digested the worm. The reason for such bizarre fare is that parasitic worms are competing with man for his food supply. Dr. Inglis believes that a study of such worms—roundworms, pin worms, eel worms—and how they can remain in the human digestive tract after all else is digested is vital to man.

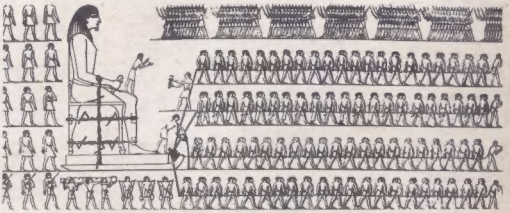
In this issue . . .

After centuries as a curiosity, magnetism is now vital to a host of new products like video tape. See Page 62.



Lunar Orbiter was supposed to take pictures of the moon, and it did. But it also photographed the first view of earth from space. Page 10.

Pity the human nose. It has been laughed at, abused and usually ignored. Yet your sense of smell is exceedingly important, as science is now realizing. See page 81.



Without steam engines, pulleys, horses or even the wheel, ancient peoples managed to move monuments weighing tens or hundreds of tons. How could they do it? See page 91.

A technological school in New York offers a full-time program in woodworking. See "The College Scene," page 42.

Eddie Rickenbacker spent three weeks on a raft in the middle of the ocean, and survived. Could you live through such an experience? Learn the rules in the story on page 57.

Charles Conrad commanded the next to last Gemini mission. Now that the two man program is over, all eyes are on Apollo. See page 38.